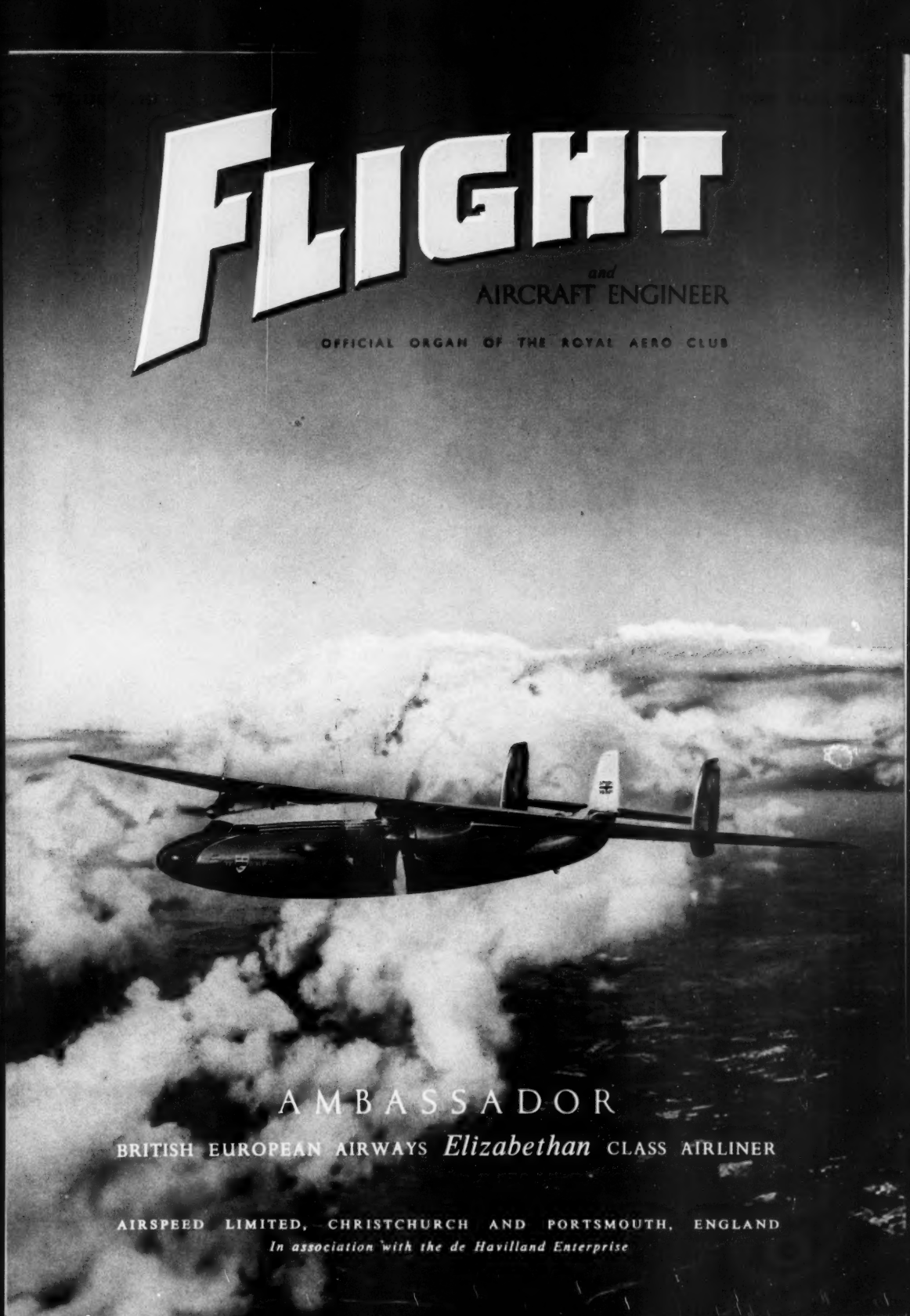
FLIGHT

and

AIRCRAFT ENGINEER

OFFICIAL ORGAN OF THE ROYAL AERO CLUB



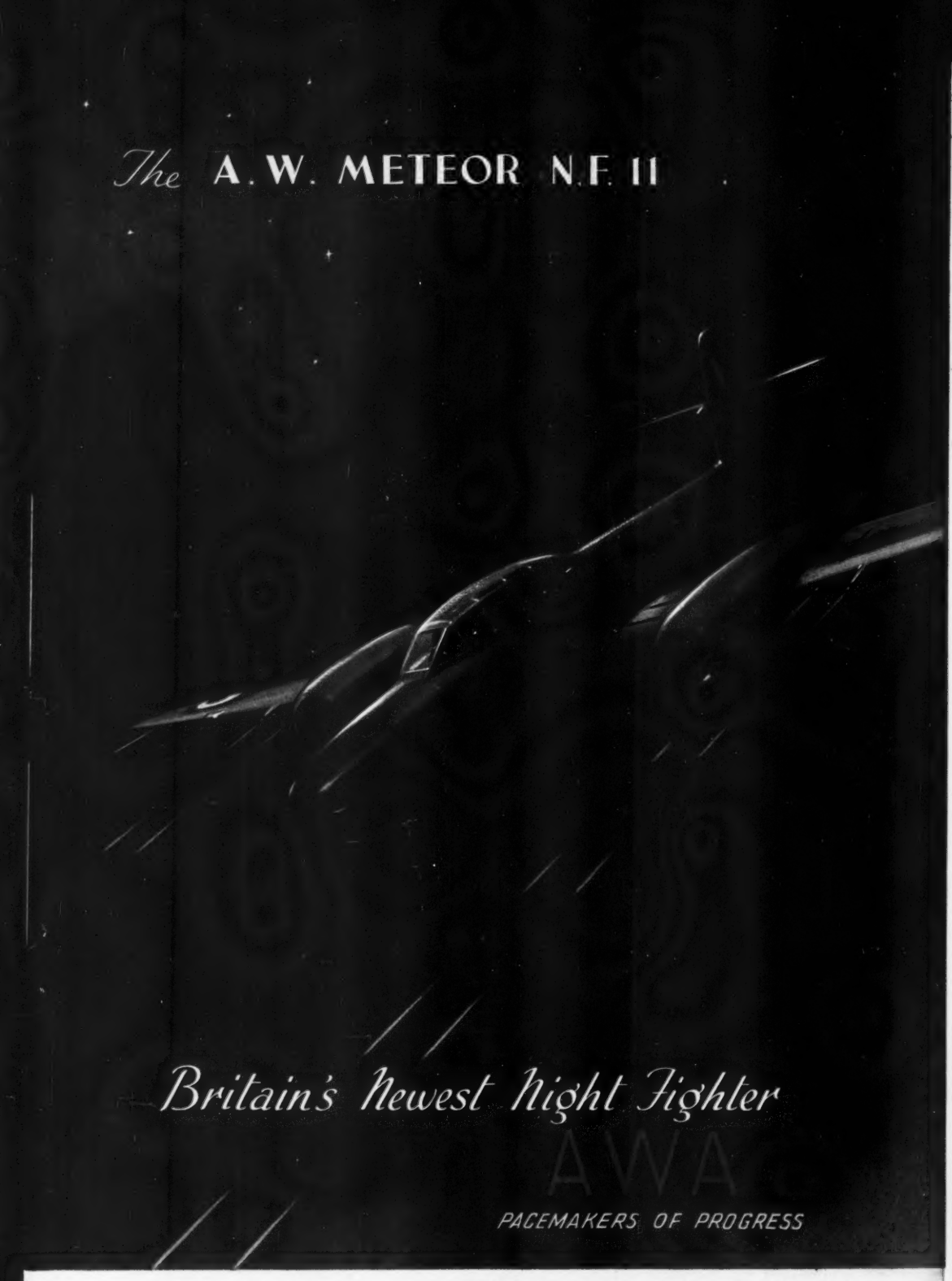
AMBASSADOR

BRITISH EUROPEAN AIRWAYS *Elizabethan* CLASS AIRLINER

AIRSPEED LIMITED, CHRISTCHURCH AND PORTSMOUTH, ENGLAND

In association with the de Havilland Enterprise

The A.W. METEOR N.F. 11



Britain's Newest Night Fighter

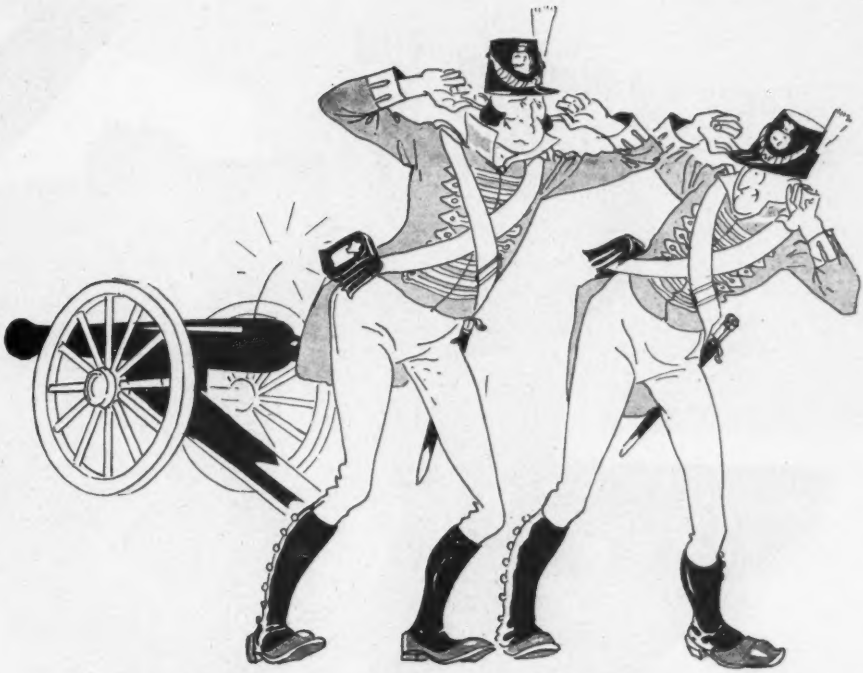
AWA

PACEMAKERS OF PROGRESS

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LIMITED, BAGINTON, COVENTRY

MEMBER OF THE HAWKER SIDDELEY GROUP

COGENT



Light fuse and retire . . .

A timed sequence of events with varying degrees of 'delayed action' has many times been called for in our long history—but rarely more insistently than in the present phase of aeronautical development. 'Teddington' have again met the demand—a typical unit being the time delay switch (colourfully christened Type FHM) embodying up to three cams, each operating a bank of spring leaf switch contacts. The potential "permutations" of these switching operations are great indeed, and the starting of gas turbines is by no means the only application of the Teddington time switch.

Teddington

Teddington CONTROLS

TEDDINGTON CONTROLS LTD., CEFN COED, MERTHYR TYDFIL, SOUTH WALES. Merthyr Tydfil 666

T.62

A

There's a place for YOU in the R.A.F.

If you enjoy working as one of a team, the Royal Air Force offers you a purposeful and rewarding career. Those selected for Pilot or Navigator under the new Aircrew scheme will gain commissions when they successfully complete their initial training. Short service engagements are offered to all who are anxious to fly, with generous gratuities at the end of 8 years' service: £1,500 for officers and up to £600 for N.C.Os. National Servicemen can be granted 4 year commissions as Pilot or Navigator. And everyone has the chance to stay on and make the Royal Air Force a full career with a pension on retirement. There's a place for you in the R.A.F.—the coupon below brings you full particulars.

Good Pay—Good Prospects

Pay and promotion in the R.A.F. are now so good that a pilot can be earning over £1000 a year (including marriage allowance) in less than 8 years from joining. And, of course, all normal living expenses are free.

Commissions for Technicians

Selected technicians from aeronautical and allied industries can obtain short service commissions in the Technical Branch of the Royal Air Force. Generous gratuities payable on termination of engagement.

Send for booklet today

TO: ROYAL AIR FORCE (F.R.27.) VICTORY HOUSE, LONDON, W.C.2.
Please send details of life in the R.A.F. (Tick which you require)
Applicants from British Isles only.

(A) In the Air		(B) On the Ground	
(C) Technical Commissions			

NAME _____

ADDRESS _____

_____ AGE ____

★ IF YOU ARE 14-17—AND KEEN—JOIN THE AIR TRAINING CORPS ★

SCOTT'S description of his native land could be appropriately applied to many parts of America, Asia and Africa; it is also an excellent description of the kind of country, impracticable to the average aircraft, where the Sealand is very much at home. Mountains or marshes, jungle or scattered islands present no difficulties to this adaptable amphibian; nor do lack of airport facilities—it asks only a little stretch of water for its comings and goings. And its uses are as diverse as its field of operations—it functions efficiently and economically as a passenger or freight carrying craft, or in any one of a score of specialised capacities—survey, police, coastguard, customs, ambulance duties and many more. With its remarkable aptitude for difficult work in inaccessible places the Sealand has already solved several knotty little problems of aircraft operation for private and official concerns—there are many more to come.

DESIGNED FOR AREAS WHERE FREIGHT AND PASSENGER CARRIAGE IS IMPRACTICABLE FOR NORMAL AIRCRAFT

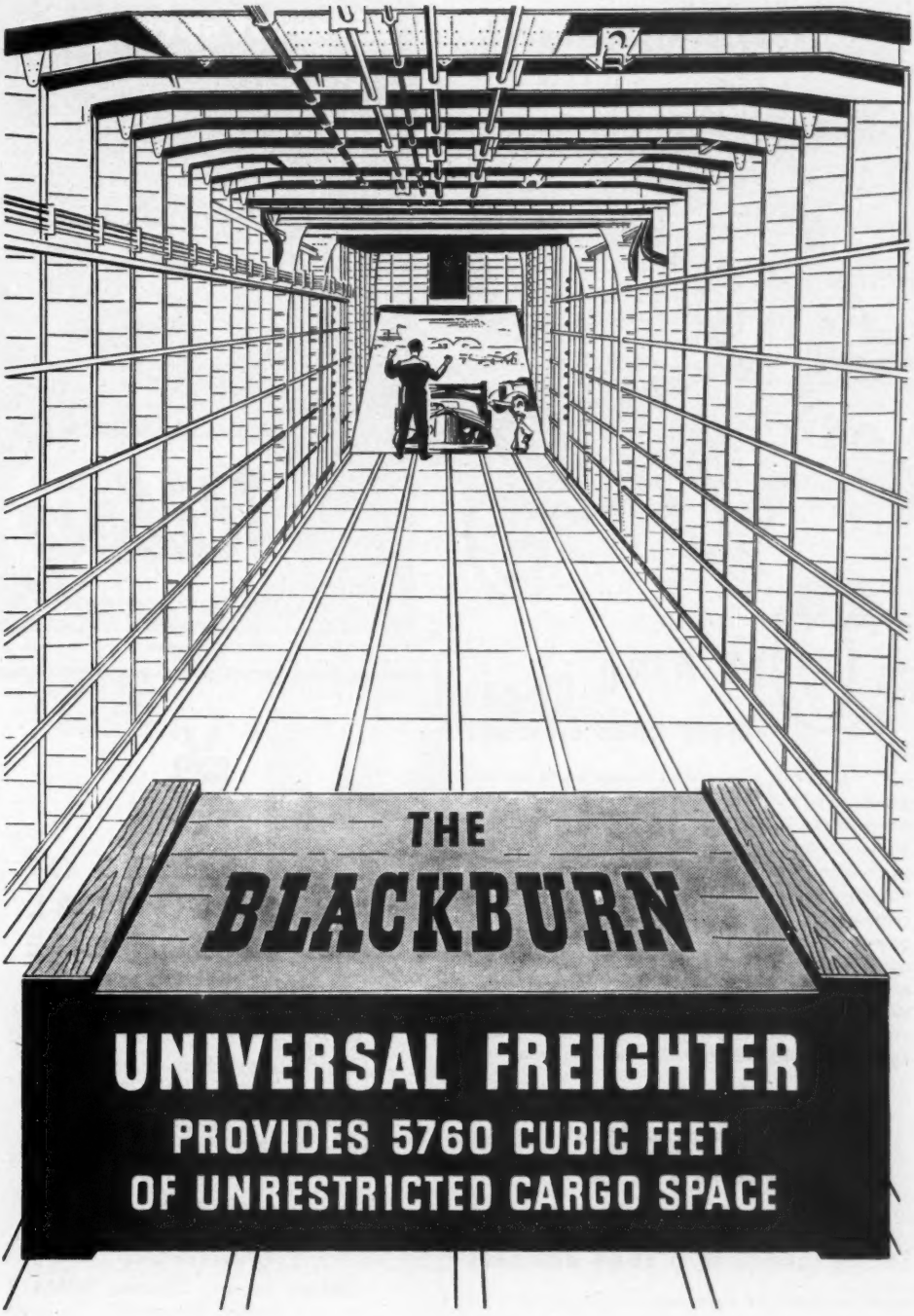
Shorts SEALAND AMPHIBIAN

SHORT BROTHERS & HARLAND LTD. *The first manufacturers of aircraft in the world*
QUEENS ISLAND, BELFAST LONDON OFFICE: 17 GROSVENOR STREET, W.1

Fitted
as standard equipment
on all de Havilland aircraft
including the Comet.

DAGENITE AIRCRAFT BATTERIES

PETO AND RADFORD · 50 GROSVENOR GARDENS · LONDON · SW1


THE
BLACKBURN
UNIVERSAL FREIGHTER
PROVIDES 5760 CUBIC FEET
OF UNRESTRICTED CARGO SPACE

UNUSUAL PROBLEMS
SOLVED WITH **Bostik**

CASE 3

OLD KING COAL must keep moving!

ONCE COAL IS CUT it must be conveyed. In fact, next to coal-cutting, coal conveying is the most important part in the vital work of wresting black diamonds from Mother Earth. The conditions under which conveyor-belts operate are very severe indeed. Cuts occur in belt after belt. A Bostik Sealing Compound impervious to water has been produced for the purpose of repairing these cuts. It wouldn't strike the average person that an industrial Sealing Compound could play such an important part in coal mining. And perhaps it hadn't occurred to you, until now, that Bostik products of one grade or another might be the solution to an industrial sealing or adhesive problem of your own. Brief details to B.B. Chemical Co. Ltd., Ulverscroft Road, Leicester, could be the turning point.

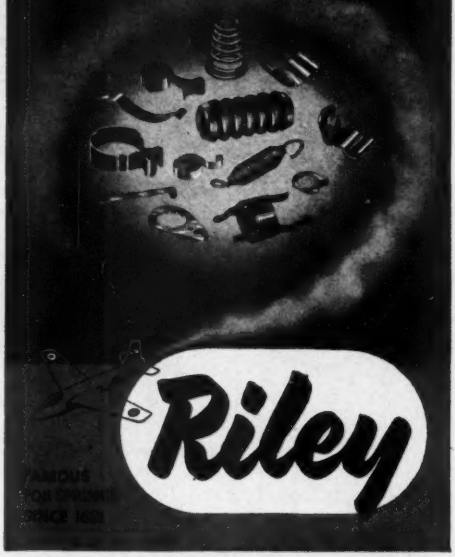
There might well be a use for

Bostik

Industrial Adhesives and
Sealing Compounds in **YOUR Business**

★ *FESTIVAL OF BRITAIN—See how Modern Life depends on* R·U·B·B·E·R

aircraft springs by



ROBERT RILEY LTD, HALESTOWN SPRING WORKS, HALESOWEN. Phone: Halesowen 2221 (4 lines). Grams: "Springing, Halesowen."

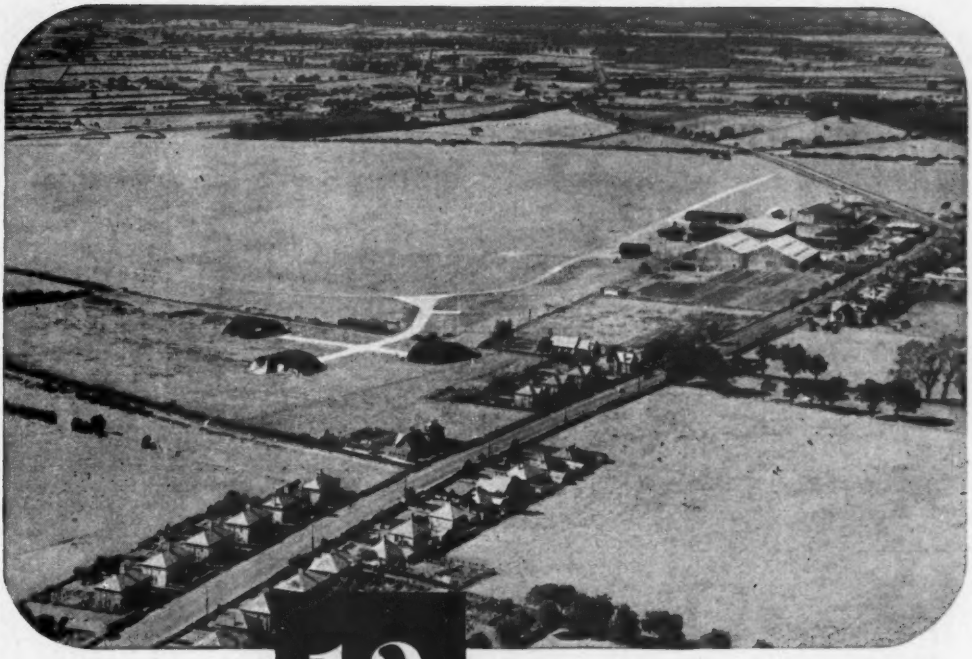
THE COLLEGE OF AERONAUTICAL AND AUTOMOBILE ENGINEERING
(The Chelsea College)

Complete practical and technical training for entry to Civil and Commercial Aviation or the Automobile Industry.
Entry from School-leaving age

Training for
AIRCREW TECHNICAL EXAMINATIONS
(Issues and Endorsements)
Syllabus from Bursar

Sydney Street, Chelsea, S.W.3
Telephone: FLAxman 0021

Do you know your airfields?



13

Recognise this airfield? It's No. 13 in this series of puzzle photographs. You'll find the answer below on the right.★

At twenty-five aerodromes throughout the country, the circling of your plane overhead is the signal for the familiar Shell and BP Aircraft Servicing Vehicle—on duty all the year round—to drive across and meet you as you taxi to a stop. Landing an Auster on a pleasure trip, or a Dakota with thirty passengers, you can always be sure of the same quick, friendly attention from the Shell and BP Aviation Service.

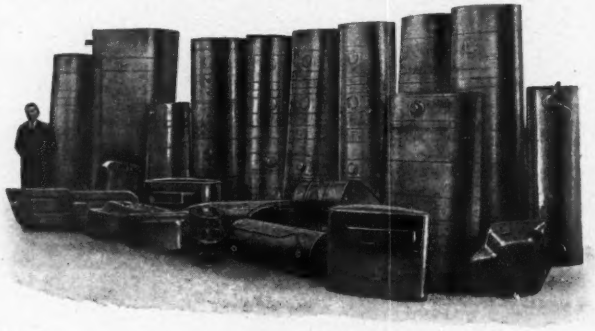
Shell and BP Aviation Service

Shell-Mex and B.P. Ltd., Shell-Mex House, Strand, W.C.2.
Distributors in the U.K. for the Shell and Anglo-Iranian Oil Groups.

★ Kingstown, Carlisle.

EVERYTHING IN SHEET METAL WORK

AND LIGHT ENGINEERING



AIRCRAFT
AUTOMOBILE
COACH AND BUS BODIES
Municipal and other ALL-METAL Vehicle Bodies

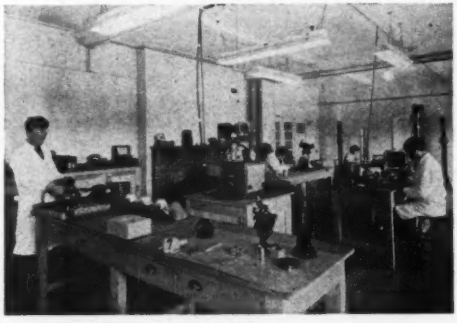
Refrigeration
COLD STORAGE
HEATING
DRYING
AIR Conditioning
MINING

TELEGRAMS: BROMELPAR, SOUTHTOT, LONDON

E. G. Brown & Co. Ltd

TELEPHONES: TOTTENHAM 2257, 2258 & 2259

161 West Rd., TOTTENHAM — LONDON, N.17



A.I.D. & A.R.B. APPROVED STOCKISTS

WYNN

of all types of AIRCRAFT INSTRUMENTS

Also

AIRCRAFT ELECTRICAL ACCESSORIES

Immediate delivery in quantities

E. D. WYNN & CO

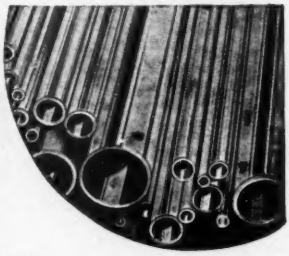
STAVERTON AERODROME

CHELTENHAM RD · GLOUCESTER

Phone: Churchdown 3264 (3 lines) *Grams: "Wynn, Gloucester"*

K/ED. 5.

K



ALUMINIUM and LIGHT ALLOY TUBES

FOR MODERN AIRCRAFT CONSTRUCTION

Larger machines . . . faster speeds . . . advance in aircraft design brings new problems in structural stresses. Significant, therefore, of the unfailing dependability of 'K' Light Alloy Tubes is their increasing use in modern aircraft construction.

Durcilium (Regd.) Alumagnese

Manufactured under the strictest technical control, 'K' Light Alloys conform to A.I.D. and A.R.B. specifications.

E. & E. KAYE LTD.

PONDERS END · ENFIELD · MIDDLESEX

Telephone: Howard 1601 Telegrams: Kaye, Enfield

TAYLOR 2497

FIRTH BROWN 1837-1951

EXPERIENCE & DEVELOPMENT IN HIGHEST QUALITY STEELS OF ALL GRADES

As manufacturers of Alloy Steels for High Duty, Firth Brown's contribution to industry is world wide, whether it be steels for engineering, shipbuilding, automobile, aircraft, road and rail transport or for the most minute mechanisms of the precision engineering industries. Firth Brown Steels were used for parts of the De Havilland "Comet."

LIST OF PRODUCTS

Forgings—Light and Heavy for Special and General Engineering

Forged Steel Drums and Pressure Vessels

Hardened Steel Rolls

Carbon and Alloy Steel Bars and Billets

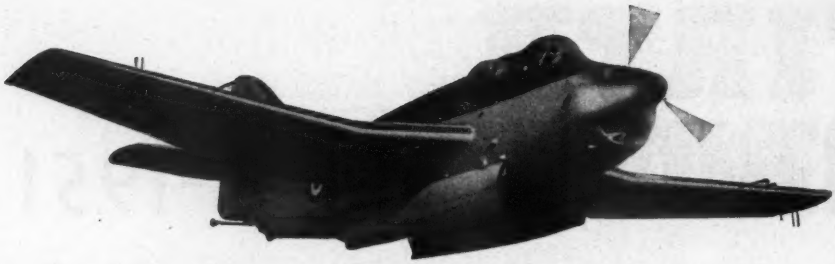
Tyres and Laminated Springs

High Speed and Tool and Die Steels

Steel Castings

Write for the Firth Brown Buyers' Guide for further particulars.

THOS. FIRTH & JOHN BROWN LTD., SHEFFIELD



STRIKING

Large bomb bay carries attack weapons

STRIKING DOWN

Double-fold wings are power folded

FAIREY GANNET

(FAIREY 17)

ARMSTRONG SIDDELEY DOUBLE MAMBA

TWIN-ENGINED • ANTI-SUBMARINE • CARRIER-OPERATED

CHOSEN FOR SERVICE IN THE ROYAL NAVY

THE FAIREY AVIATION COMPANY LIMITED, HAYES, MIDDLESEX

FLIGHT
and
AIRCRAFT ENGINEER

First Aeronautical Weekly in the World

Founded 1909

No. 2218 Vol. LX. FRIDAY, 27 JULY 1951

EDITOR
MAURICE A. SMITH, D.F.C.

ASSISTANT EDITOR
H. F. KING, M.B.E.

TECHNICAL EDITOR
C. B. BAILEY-WATSON, B.A.

ART EDITOR
JOHN YOXALL

Editorial, Advertising and Publishing Offices:
DORSET HOUSE,
STAMFORD STREET,
LONDON, S.E.1.

Telegrams, Flightpres, Sedist, London.
Telephone, Waterloo 3333 (60 lines)

Branch Offices:
COVENTRY
8-10, Corporation Street.
Telegrams, Autocar, Coventry.
Telephone, Coventry 5210.

BIRMINGHAM, 2
King Edward House,
New Street.
Telegrams, Autopress, Birmingham.
Telephone, Midland 7191 (7 lines).

MANCHESTER, 3
260, Deansgate.
Telegrams, Iliffe, Manchester.
Telephone, Blackfriars 4412 (3 lines).
Deansgate 3595 (2 lines).

GLASGOW, C.2.
26b, Renfield Street.
Telegrams, Iliffe, Glasgow.
Telephone, Central 1265 (2 lines).

SUBSCRIPTION RATES
Home and Overseas: Twelve months £3 3s. 0d. U.S.A. and Canada, $10.00
BY AIR: To Canada and U.S.A., six months, $16.

IN THIS ISSUE:

Saturday at Hendon - 98
Sikorsky Lecture - - 105
Transformable Delta Project - - - - - 107
Hors-D'Oeuvres Varies - 110
Evolution of the Guided Missile - - - - - 113
Fifty Years at Hendon - 117

"The Helicopter Is Here To Stay"

THE appreciation of the crowds as they followed the gyrations of the helicopters taking part in the *Daily Express* "Fifty Years of Flying" Display at Hendon, reminded us that many present had never before seen a helicopter demonstrated. Pursuing this train of thought, two other impressions were formed: the first, that people associated with the aircraft industry quickly (and to their own disadvantage) tend to become blasé about all kinds of flying demonstrations, however remarkable; the second, that in the recent few years which have terminated the long period of tentative exploration, enormous progress has been made with rotating-wing aircraft.

By comparison with its sleek-lined, high-speed, fixed-wing contemporaries the helicopter is a gawky relative, and even familiarity with its form does little to mellow the outlandish angles and curves. A glance at the early experimental rotating-wing machines shown in the static park at Hendon, however, leaves no doubt as to the tremendous improvement which has been made through the years. Having regard to its age, the Cierva C-24 Autogiro of 1931 alone approaches the shapeliness of, say, the Bristol Sycamore, which may be regarded as one of the best-lookin8 helicopters now flying.

That no entirely suitable commercial passenger-carrying design has as yet reached the operational stage (and thus the few who pay their fare and fly to-day do little more than co-operate in an experiment) is apt to cloud one's appreciation of what has, in fact, been achieved. For the carriage of mail a remarkable record has been established in this country and in the United States. In the military field, for sure, the helicopter has astonished even its staunchest supporters by demonstrating in action the excellent and varied service it can give. Korea may come to be remembered in history as the war which proved the military helicopter. As for the other fields of application, anyone who reads a newspaper could tell of the manifold services rendered by helicopters every day.

It has been a pleasure recently to have Mr. Igor Sikorsky on a visit to this country. His lecture before the Helicopter Association, and the discussion which ensued, are summarized on pages 105-106, while the words of this pioneer designer-pilot provide the title for this editorial. In view of the close ties between the American corporation with which he is associated and the British Westland company, it was to be expected that opinions expressed by officials when the Westland-Sikorsky S-55 was demonstrated for the first time over here last month would coincide with much that Mr. Sikorsky had to say. For example, he favours the single-rotor configuration. It is worth bearing in mind, moreover, that this modest and successful expert believes that the design of gearing for use between a gas turbine power unit and rotating wings would not by any means prove to be an insurmountable problem, although there are certainly difficulties. This last fact can hardly be doubted, for, while the turbine may be turning at, say, 15,000 r.p.m., the blades of a large helicopter would probably not exceed a few hundred r.p.m. Mr. Sikorsky stated his conviction, in answer to a question, that a well-built mechanical transmission system could give excellent service and was undoubtedly the most efficient way of transferring power from engine to rotor.

Few protagonists of the jet-driven blade agree with Mr. Sikorsky, but it may be mentioned that those who have had experience of the so-simple ramjet type of blade propulsion are noticeably guarded about their achievements to date. Their enthusiasm is unabated, but operationally there have been unexpected fuel-supply and other problems. We believe nevertheless that their early endeavours will be rewarded.

In passing, attention must be drawn to the photograph on page 106 depicting—for the first time—a new type of Russian military helicopter. Korea lessons have no doubt impressed the Russian authorities too.

The backing and impetus provided by increasing military requirements, though they may temporarily upset civil developments and deliveries, will no doubt go a long way towards overcoming the helicopter's largest single drawback so far as commercial and possibly, private operation is concerned. We refer to expense—of development, production, maintenance, and of the training for the pilot, for whom, incidentally, there is not at present a single civil school in this country.

The skies over Hendon last week welcomed back the nimble Sopwith Pup of the First World War.

SATURDAY AT HENDON

Illustrated with "Flight" Photographs

From 50 m.p.h. to a 1,000 m.p.h. "Crossover"

ALTHOUGH no official information was available at the time of going to press, it was estimated by the organisers that between eighty and ninety thousand people were present at Hendon last Saturday for the final day of the *Daily Express* "Fifty Years of Flying" display.

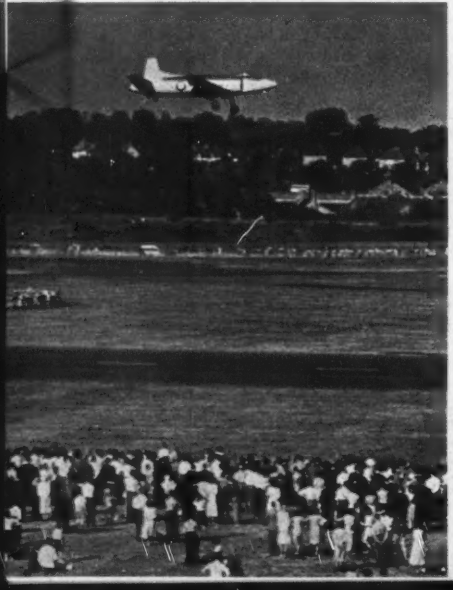
Happily, a sunny turn of weather endured throughout the afternoon, and, as far as we know, the only customer who was not completely satisfied was the small boy who was heard to observe—with no little disgust—"the 'Blerryott' ain't much good if it don't loop-the-loop."

Though apparently not up to the expectations of small boys, the 1909 Blériot monoplane (which, as on the previous evenings, opened the flying programme) nevertheless put up an extremely good show. With Lt. J. Elliott, A.F.C., "in the chair," its flight on this occasion consisted of one long hop which carried it halfway down the airfield; this led into a daring 90-degree turn before the machine settled down to a really silky landing. In the hands of W/C. T. D. Calnan, the 1911 Déperdussin monoplane—two years the junior of the Blériot—then trundled cautiously off into wind. It flapped urgently once or twice but seldom achieved more than a few feet of altitude.

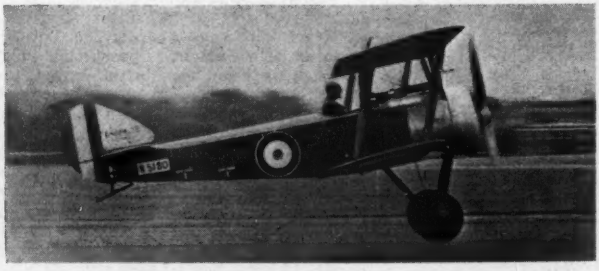
In complete contrast, the Blackburn monoplane (1912), flown by S/L. G. Banner, D.F.C., performed with astonishing agility; it made two complete circuits of the airfield including some surprisingly steep turns.

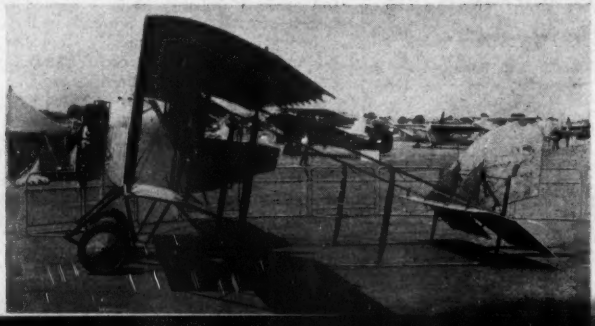
W/C. "Dicky" Martin handled the Sopwith Pup beautifully and trotted out a surprisingly extensive range of aero-

With undercarriage and hook lowered, the Vickers-Supermarine Attacker F.1 flies past on a simulated deck-landing approach.

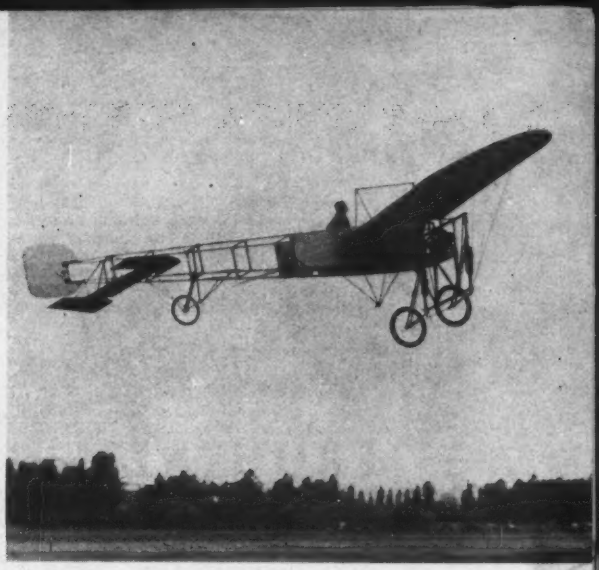


The trim little Pup gets off without delay for an aerobatic session, and below it, a real old-timer displayed in the static park was this Caudron biplane of 1912.





The Cierva C-30 Autogiro showed agility belying its years.



The 1909 Blériot monoplane looked good for a cross-Channel flight.

batics for a machine of 1916 vintage. He was followed by "Bill" Pegg in the Bristol Fighter, who had obviously been practising hard at his special brand of barrel roll, in which he literally hurls his machine round its fore and aft axis with a Vampire-like rate of roll.

The next section of the programme was contributed by rotating-wing aircraft, as typified by the Cierva C-30 Autogiro (piloted by Norman Hill) the Westland S.51, and the Bristol 171, flown by Lt. K. M. Reed and C. T. D. Hosegood respectively. The C-30 gave an individual exhibition while the other two machines performed simultaneously before the east and west enclosures. A spot of mock-warfare, in which a Jeep supposedly struck a mine, gave the helicopters an opportunity of showing something of their usefulness in front-line rescue work.

Three gliding items were next on the agenda. They comprised a demonstration of winch-launching by a Dagling primary glider; a Prefect giving a few aerobatics; and, finally, an impeccable exhibition by Marmol in his Kranich sailplane, in which he pulled what must surely have been one of the lowest and tightest loops ever attempted.

The final part of the programme—contributed by modern powered-aircraft—completed the aviation story. This consisted of displays of Sea Fury 11s of No. 802 Squadron from R.N.A.S. Culdrose, an independent aerobatic session by an Attacker (flown by Lt. P. E. Atterton), and some choice formation aerobatics by three Vampires of No. 72 Squadron, with their C.O. S/L D. E. Kingaby, D.S.O., D.F.M. leading the section. The Sea Furies' rolls in tight formation were a delight to watch but the Attacker proved rather less spectacular than might have been expected. The Vampires' contribution showed that the R.A.F. has certainly no intention of leaving the laurels for "jettery" demonstrations permanently in the hands of the U.S.A.F.'s "Skyblazers." Never separated by more than a half-span, the three Vampires included some excellent upward rolls in formation and—a most impressive manœuvre—a change of formation while inverted on top of a loop.

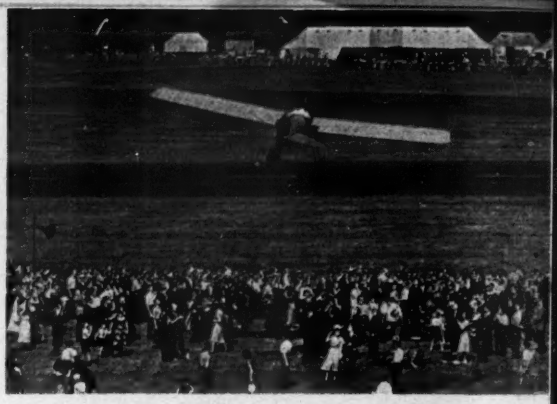
As a fitting climax to the afternoon, S/L. Kingaby detached his machine from the formation and ninety thousand spec-

With folded wings, the Sea Fury 11 fighter-bombers of No. 802 Squadron taxi down the "deck" before ranging for take-off.

SATURDAY AT HENDON . . .

tators witnessed a hair-raising "head-on at nought feet" with the actual cross-over beautifully timed to take place in the centre of the airfield. A slight jink at the last second took Kingaby's machine through the narrow gap between the other two onrushing Vampires at a closing speed approaching 1,000 m.p.h.

Like ourselves, many spectators must still be thinking about it.



The Blackburn monoplane of 1912 was undoubtedly the star performer among the three "oldest inhabitants."

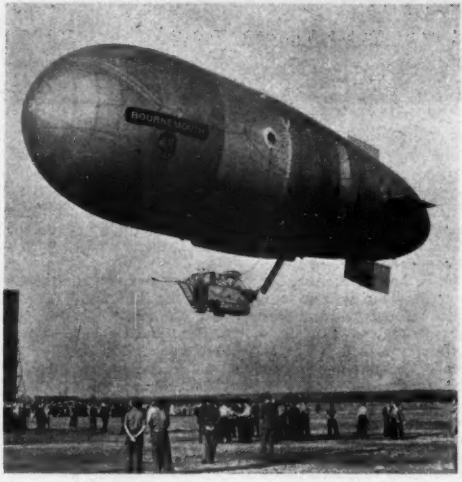
FROM ALL QUARTERS

The "Bournemouth" Flies

HAPPILY coinciding with the opening of the "Fifty Years of Flying" display at Hendon, the airship *Bournemouth*—the first to have flown in this country since the R.101—took the air on her maiden flight on July 19th. The scene was R.A.F. Station Cardington, Beds., a base long associated with British lighter-than-air flying, and the crew were Capt. J. Beckford Ball (in command), Mr. Freddie Twinn and F/L. H. Richardson. Lord Ventry, moving spirit of the Airship Club (members of which constructed the little ship), was obliged to give up his place to F/L. Richardson, being—at 17 stone—somewhat overweight, which sad condition he attributed to having given up smoking.

Before an assembly of several thousands of people *Bournemouth* ascended for a 20-minute trip. Her alighting (with the aid of a volunteer R.A.F. handling crew) is reported to have been on the heavy side, but Capt. Beckford Ball remarked that his charge had not done too badly in the air, though stern-heaviness had given him some trouble. It may, in consequence, be necessary to move the car forward before flight trials are resumed.

A description of *Bournemouth* appeared in *Flight* of November 16th, 1950.



UP SHE RISES: "Bournemouth" takes the air (see adjoining paragraph.)

Investigation by Safir

RESEARCH work has been completed recently by the Saab Aircraft Company, of Sweden, in connection with the development of their high-speed swept-wing fighter, the Saab-29, now in service with the Swedish Air Force. This work has been greatly expedited by the use of a Saab-91 Safir, suitably modified to obtain information at the design stage, having a wing of relatively moderate sweepback (25 deg), to investigate, among other things, the stalling characteristics at low speeds. The reliability of the tests is clearly evidenced by the fact that information obtained with the use of automatic leading-edge slots was such that these fitments were successfully incorporated on the Saab-29 without subsequent modification. Similar tests have been made with a Safir having a wing of greater sweepback than the Saab-29.

In order to develop a new de-icing system for a projected Saab type an unswept Safir has been used to find a suitable method for spraying de-icing fluids along the leading edge. A test section on the port wing was subjected to controlled icing conditions.

London Club Dance

ALTHOUGH the annual dances organized in recent years by the London Aeroplane Club have all been marked successes, many guests at this year's affair applauded the decision to hold it in the old club premises, now almost buried among the de Havilland factory buildings at Hatfield. The club house (or senior canteen as it now is) is still a most attractive building and retains much of its original atmosphere. Add, as was the case last Friday, the swimming pool, terrace and tasteful coloured lighting and the setting is near-perfect. The London Club (now a branch of the D.H. Technical School for administrative reasons) and the organizers, personally, are to be congratulated upon one more in a succession of most enjoyable evenings.

FIRST APPEARANCE: The Miles Aries made its début at the Hendon display. This Gemini development has increased luggage capacity—in a locker behind the cabin—and is distinguished by the larger nacelles (for two Cirrus Majors) and taller fins and rudders. A.C. of A. is awaited for an all-up weight of 3,475 lb.

"Flight" photograph

FROM B TO A: Following successful flight trials with the delta-wing Avro 707B (itself derived from the original 707), the 707A recently made its first flight at Boscombe Down, piloted by Mr. R. J. Falk, whose portrait appears here with one of the first views of the new aircraft. It will be seen that the intakes for the Rolls-Royce Derwent are in the wing roots and that the dorsal fin has been extended forward. Dimensions are: span, 34ft 2in; fuselage length, 34ft 4in. Sir Roy Dobson, Avro's managing director, has spoken of the delta layout as offering the "lowest possible" drag and a high degree of manœuvrability at altitude.

Death of Mr. J. D. Ellor

WITH deep regret we record the death of Mr. James Edwin Ellor, assistant chief engineer at Rolls-Royce, Ltd. Mr. Ellor died in Middlesex Hospital, London, on July 16th, after enduring a protracted illness; he was 59.

Mr. J. E. Ellor

Mr. Ellor joined Rolls-Royce 24 years ago and proved himself one of the most gifted engineers on the company's technical staff. On his appointment in 1927 he was made responsible for development work on superchargers, and it was shortly after this that a single-sided centrifugal blower was fitted to the Rolls-Royce Kestrel. He later assisted in the development of a supercharger for the Rolls-Royce "R" engine which powered the Supermarine S.6, Schneider Trophy winner of 1929. His work on superchargers for the "R" engine led to the development of a single-stage, and later a two-stage, supercharger for the Merlin. During the war years Mr. Ellor was sent by Rolls-Royce to the U.S.A., as technical representative of the company, to assist the Packard Motor Co. in the production of the Merlin engine.

In the post-war years Mr. Ellor's specialized knowledge has been applied to the development of compressors for gas turbines, and he has been responsbile for research work on the Derwent, Nene and Avon engines. Mr. Ellor was a Fellow of the Royal Aeronautical Society, a life member of the Society of Automotive Engineers, and a member of the Institute of Aeronautical Sciences.

Conference Arrangements

MORE details are now available concerning the Anglo-American Aeronautical Conference, to be held at Brighton from September 3rd to 7th. Over 500 delegates, representing official and industrial establishments, will attend, including 395 from America, of whom 43 are bringing their wives. Under the chairmanship of Mrs. Halford, a committee has been formed to take special care of the American guests, and the nature of the problem facing the committee and Capt. J. L. Pritchard will be realized when comparison is made with the 1947 conference figures—44 British delegates and 42 American. (It will be remembered that, although Capt. Pritchard has retired from the Royal Aeronautical Society, he has agreed to make the necessary arrangements for the conference, and all inquiries should be forwarded to his office at the Society.)

Brighton Corporation are being generous in their help to make the conference a success, and they have placed the famous Dome and Corn Exchange at the disposal of the Society for the opening session and lectures. The Corn Exchange is large enough for two lectures to be held simultaneously, and lunch facilities will be provided in the building itself. It is suggested that delegates should take advantage of these facilities, as quick lunches may be difficult to obtain elsewhere.

A supper and dance—in the Royal Pavilion on Wednesday, September 5th—has been arranged by the Mayor and Mayoress. The conference dinner will be on Friday, September 7th.

Admiral Forrest P. Sherman

IN recording the death of Admiral Forrest P. Sherman, United States Chief of Naval Operations, after a heart attack in Naples on July 22nd, *Flight* pays tribute to a very distinguished and gallant sailor and one who accomplished much in furthering the cause of naval aviation.

Admiral Sherman was born on October 30th, 1896, and was appointed to the U.S. Naval Academy in 1914. During the first world war he saw service in the Atlantic and the Mediterranean, and subsequently qualified as a naval aviator at the Naval Air Station, Pensacola. He served in a number of aircraft carriers, and in 1930 was appointed instructor in seamanship and flight tactics at the Naval Academy, Annapolis. At the outbreak of war in 1939 he was Fleet Aviation Officer on the staff of Admiral Bloch, and from 1940 to early 1942 worked in the war plans division of the office of the Chief of Naval Operations. In May, 1942, he assumed command of the aircraft carrier U.S.S. *Wasp*, which vessel he commanded when she delivered a supply of sorely needed aircraft for the defence of Malta. Admiral Sherman was still in command of the *Wasp* when she was sunk by the Japanese off the Solomon Islands. His conduct on that occasion, when he was instrumental in saving 90 per cent of his crew, earned him the Navy Cross.

Admiral Sherman was present at the Japanese surrender aboard the battleship *Missouri* in Tokyo Bay, and in 1947 was appointed to command the United States fleet in the Mediterranean. His appointment as Chief of Naval Operations dated from 1949.

OVER TO YOU—: Air Commodore Strang Graham of English Electric delivers the requisite documents into the hands of W/C. D. R. Cuming, who, as mentioned on page 103, recently took over the first Canberra jet bomber for the R.A.A.F. Others in the group are Mr. W. Shorrock (E.E. works manager), F/L. C. G. Harvey, R.A.A.F., and (extreme right) W/C. Roland Beamont, chief test pilot, English Electric.

HERE AND THERE

International Exercise

A SQUADRON of Vampires of the Royal Norwegian Air Force, based on the R.A.F. station at Gütersloh, has been participating in Exercise Scandia One in the British zone of Germany. Danish, Norwegian and British troops were engaged.

Elementary Navigation

WITH nothing more than a K.L.M. passenger route map with which to navigate, W/C. Zahir Ahmed, C.F.I. of the Northern India Flying Club based at Lahore, recently flew solo from Rearsby to his base at Lahore in an Auster Aiglet. His flying time was 41 hrs 45 min, spread over eight days.

Express Delivery

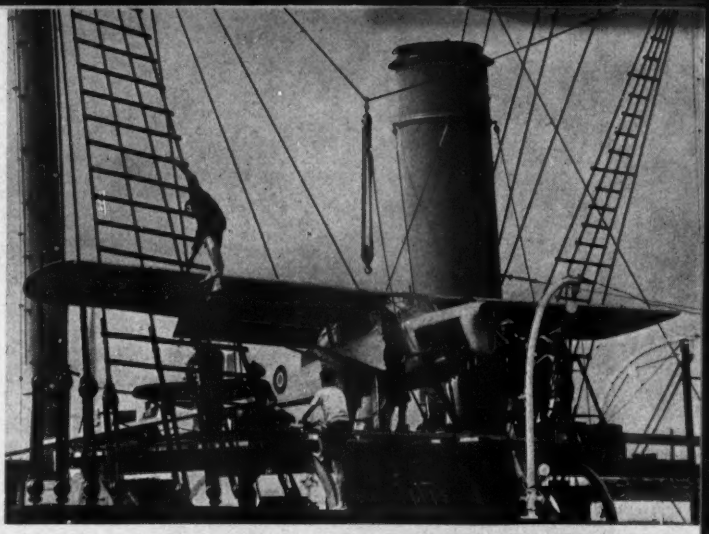
THE D.H. Comet which flew recently from London to Johannesburg, carried a letter of greeting from the South African High Commissioner in London to the Union's Prime Minister, Dr. D. F. Malan. It was delivered within 24 hours of being written and contained good wishes for the speedy introduction of Comet Springbok services.

Wings to Wheels

CAPTAIN Geoffrey Greenhalgh, B.E.A.'s Flight Captain at Liverpool, is apparently equally proficient at the wheel of airliner or motor-car. Driving a 1½ litre M.G. in the Welsh Rally, he literally "cleaned up" the trophy table. Capt. Greenhalgh considers his success as being due to a perfect "met." forecast.

Leicestershire Display

THE organizers of the Leicestershire Aero Club rally, which is to be coupled with an air display at Leicester East airfield on August 11th, have had the happy notion of displaying veteran and modern cars in addition to aircraft. Visitors will also be treated to displays by R.A.F. jet fighters, parachute exhibitions and acrobatics.



UP FOR THE FESTIVAL: An Auster used by the Anglo-Scandinavian Antarctic Expedition has been added to the Festival exhibition "Fifty Years of British Antarctic Exploration" aboard the "Discovery." This stout-hearted old ship is moored to the Embankment a few hundred yards across the river from "Flight's" offices.

AFTERBURNER CRAWLER-UPPERER: The business-like gentleman installed in the General Electric afterburner on the right is Mr. Harold Kirkendall who is 3ft 11in tall and is employed by G.E. to get inside information on the internal state of these devices.

U.S. Bases in Morocco

IT is announced by the U.S.A.F. that arrangements have been completed for the use by Strategic Air Command of seven bases in French Morocco. Casablanca, Rabat, Sidi Slimane, Mechra Bel Ksiri and Nouasseur are named and two sites remain to be selected.

Rotax Factory in Canada

A NEW factory for the manufacture of turbojet components is to be built in Canada by Rotax Canada, Ltd., an associate company of Joseph Lucas, Ltd., in co-operation with the Dominion Government. Six hundred workers will be employed and the cost will be 2½ million dollars.

A PALPABLE HIT: This is what Lt. Col. R. D. Saltsman, Jr., U.S.A.F., saw, and what the camera gun of his Mustang recorded, as a Communist Il-10 ground-attack aircraft "brewed up" on receiving a well-directed burst of "fifty-calibre" fire. The Il-10 is heavily armoured.

Sensitive Altitude Control

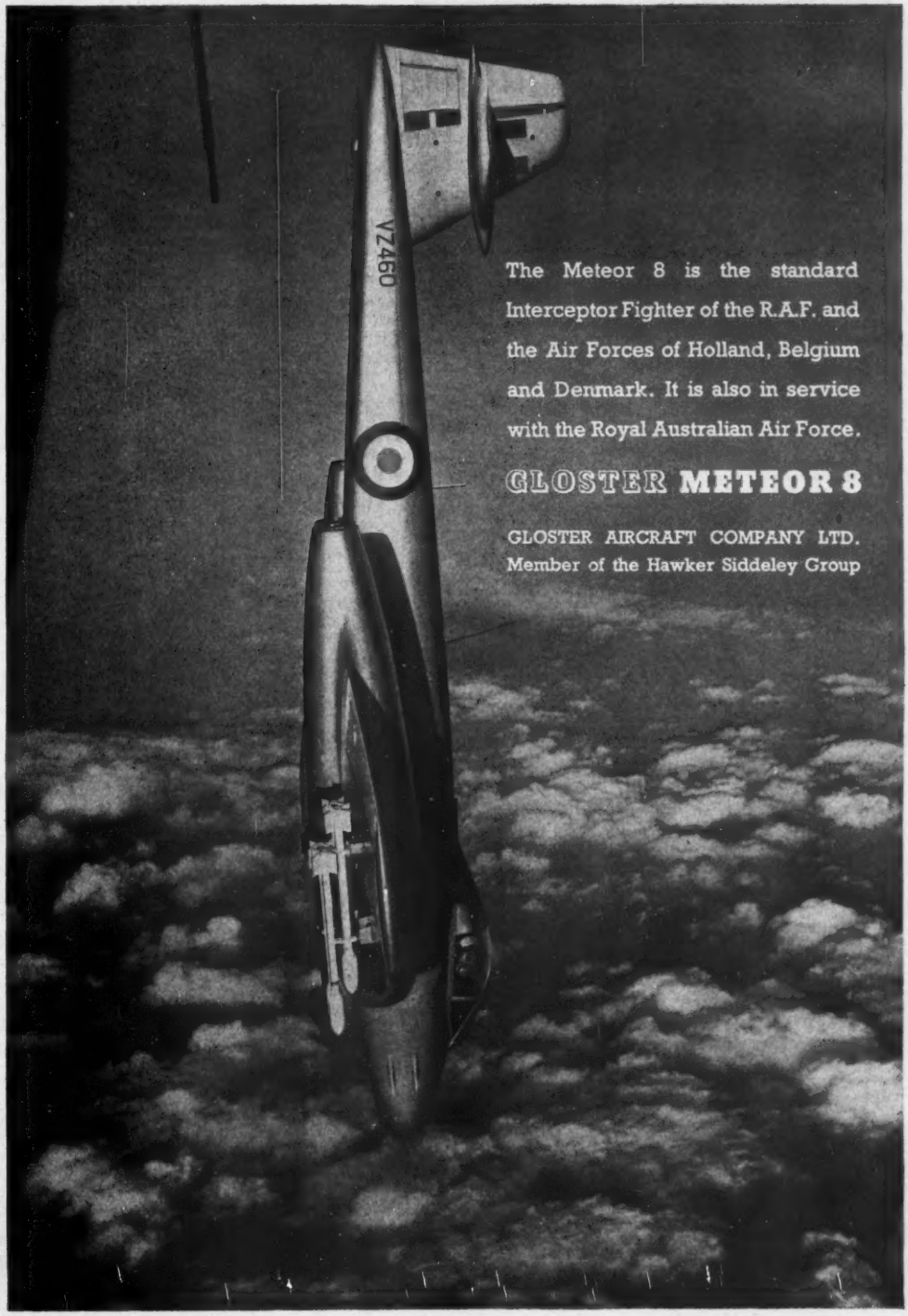
THE Minneapolis-Honeywell Regulator Co. claims to have developed an altitude-control device by which aircraft may be flown automatically at great heights to within limits of plus or minus 3 ft. Previously, 25-50ft has been considered good.

American Employment

THE U.S. Labour Department states that employment in airframe plants rose by 12,299, and in engine plants by 2,176 during March, 1951, to totals of 263,931 and 58,610 respectively. A later release gives the April combined total as 413,200, which is expected to be increased by 18 per cent by October. The average hours worked per week during April were 44.8, as against 43.7 in January.

Ford Wings

THE Ford Motor Co., of Michigan, is negotiating contracts to supply B-47 Stratojet wings to Boeing, Douglas and Lockheed, as part of their £350 million rearmament programme. It is estimated that, in order to comply with the company's production policy, 40 per cent of the wing components will be sub-contracted.


VZ460
The Meteor 8 is the standard Interceptor Fighter of the R.A.F. and the Air Forces of Holland, Belgium and Denmark. It is also in service with the Royal Australian Air Force.
GLOSTER METEOR 8
GLOSTER AIRCRAFT COMPANY LTD.
Member of the Hawker Siddeley Group

F 86 Sabre* Jets on a Canadair Assembly Line at Montreal, Canada.

They can work for *You* too!

At Canadair, many thousands of skilled employees are currently building scores of one of the world's fastest jet fighters . . . the F 86 Sabre* . . . proved in the air over Korea. From draughting tables, in machine shops, on assembly lines and in flight tests approaching the speed of sound, these Canadians work for the cause of freedom.

Canadair has nearly 2,000,000 square feet of modern factory facilities equipped with the most modern machinery . . . and room to expand into 110 acres. Backed by practical manufacturing experience and guided by senior design engineers, Canadair is equipped to design and build every type of military and civil aircraft as well as air frame parts under the most advantageous manufacturing conditions.

For further information:
European Representative, J. H. Davis, Princes House, 190 Piccadilly, London, W1, England

Vignettes of
CANADA—AIR LAND

Under the British Commonwealth Air Training Plan 360 Canadian training schools and ancillary units graduated over 130,000 aircrew for the Allied Air Forces.

Blueprinted in 1939 by the United Kingdom, Canada, Australia and New Zealand the B.C.A.T.P. is a story of air achievement unparalleled in history; a formidable task accomplished by the Royal Canadian Air Force which also contributed more than 50% of the men.

Although this great Plan was discontinued in 1945, today Canada is again providing flying instruction for her allies under the defence plans of the North Atlantic Treaty Organization . . . a further Canadian contribution to the exciting chapters of Air History.

Canadair

LIMITED, MONTREAL, CANADA

*Made under license from North American Aviation, Inc.

HERE AND THERE . . .

Australia's First Canberra

PLANS are practically completed for the despatch by air of the first Royal Australian Air Force Canberra bomber on August 1st. After collection from the English Electric airfield at Warton, the aircraft has been flown to Boscombe Down and it will position to Lyneham for Customs clearance.

The pilot on the flight to Australia—no route has yet been announced—will be W/C. D. R. Cuming, D.F.C., and with him will be F/L. C. Harvey. Both are R.A.A.F. officers. It may be remembered that W/C. Cuming, Australia's chief Service test pilot, attended the 1945 course at the Empire Test Pilots' School.

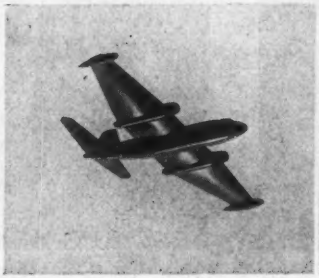
Thai Officers Entertained

THE Thai Ambassador in London, Mr. Phra Bhahidha Nukara, and officers of the Royal Thai Navy were recently entertained at Bruton Street by the Fairey Aviation Co., Ltd. It will be recalled that the handing-over of a considerable batch of Fairey Firefly 1s (which have passed through the company's factory and are delivered as new) commenced recently, and this reception was in part to mark the first delivery.

By means of films the guests were shown examples of the work of Coastal Command on the shipping routes round Norway, and the technique of rocket attacks. A colour film of the Gyrodyne, forerunner of the Rotordyne, was also screened. Among the guests were the Thai Naval Attaché, Capt. Sawasdi Kongsiri, and Lt.-Cdr. Piti Tantivess, Cdr. Siri Grachangnetra and Cdr. Chitta Sanghkadulya.

Mayoral Coach

THERE was great jubilation in the West Country on July 17th, when the Lord Mayor of Bristol (Ald. F. R. Lyne) flew in a Bristol Sycamore helicopter to Avonmouth to visit the Festival of Britain ship *Campania*. In company with Mr. G. H. Gibbs, the city sword-bearer, he was seen off by other West of England mayors. Piloted by Mr. C. T. G. Hosegood, the Sycamore circled the *Campania* three times before touching down on an 18ft square section of steel runway planking.



OPPOSITE NUMBERS in the R.A.F. and the Russian Air Force are the English Electric Canberra (left) and the new twin-jet bomber of unconfirmed designation. The first photograph of the Russian bomber ever published appeared in "Flight" on July 13; that above is the second, and is guaranteed genuine, though it has been somewhat retouched in the interests of clarity.

Ambrosini Jet Fighter

THE swept-back wings which, as announced in a previous issue, are to be fitted to an Italian Ambrosini S.7 trainer, will be scale models of those for the projected Ambrosini Vindex jet fighter. The intended armament of the fighter is said to be eight 30 mm guns, and supersonic speed is expected.

Woomera Workhorses

IN addition to the Bristol Sycamore helicopters, now being flown out, in Bristol 170s, to the Woomera rocket range in South Australia, the range authorities have Dakotas, Bristol 170s, Vickers Vikings and Austers for supply and communications.

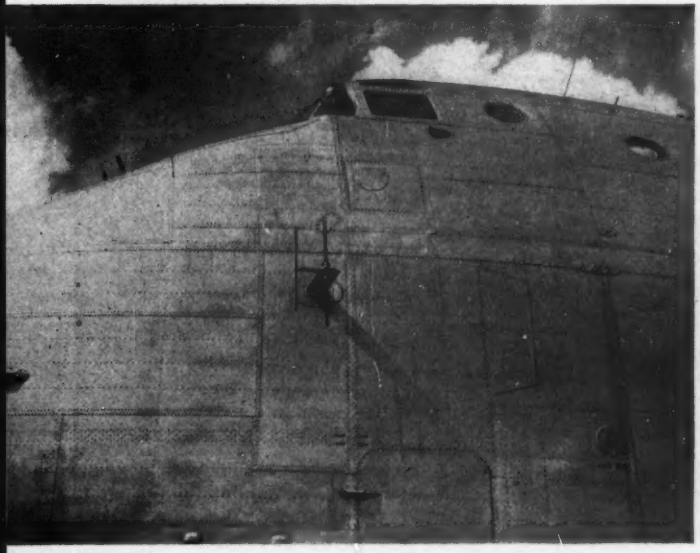
Sinking Speed

THE passenger terminal supervisor of Australian National Airways in Melbourne, Victoria, thought that he had received every inquiry pertaining to air travel, until a would-be passenger asked what he could take as personal luggage. "Everything but the kitchen sink, sir," jocularly replied the supervisor. "That's funny, that's just what I want to carry," said the passenger—and went on to explain that, as there was a shortage of stainless-steel sinks in his home town, he had flown in to Melbourne on purpose to buy one.

Northern Model Meeting

ARRANGED by the Northern Area of the Society of Model Aeronautical Engineers with the co-operation of the Yorkshire Aeroplane Club, a National Model-flying Festival is to take place on September 9th. It is sponsored by the *Yorkshire Evening News*. The venue will be announced later.

HEY, YOU DOWN THERE—: "Tim" Wood, chief pilot, Blackburn and General Aircraft, is in a commanding position at the controls of the G.A.L.60 freighter. The "bridge" is the loftiest in this country, being 21ft above the ground; the fuselage is 99 ft 2 in long.



NEWS IN BRIEF

POWER JETS (Research and Development) LTD. have appointed Mr. G. C. R. Mathieson, B.Sc., D.R.T.C., to be senior lecturer at the School of Gas Turbine Technology, Farnborough, Hampshire. Mr. Mathieson was, until recently, a senior scientific officer in the aerodynamics department of the National Gas Turbine Establishment, Pyestock. He is a graduate of Glasgow University.

* * *

The College of Aeronautical and Automobile Engineering, Sydney Street, King's Road, Chelsea, is opening its doors to all overseas visitors interested in seeing how their fellow-countrymen are being trained there. Letters to embassies have been sent out, inviting their nationals to visit the College any Wednesday afternoon (with the exception of holiday periods) throughout the Festival period.

* * *

Mr. A. G. P. Welch, former supplies representative, Aer Lingus, has been appointed general manager of Aeroservices (London), Ltd., 31, Clarges Street, W.1, which company is associated with the aircraft brokers, Aeroservices S.A.R.L., Paris.

* * *

Mr. R. L. M. Saunders, managing director of Aero Controls, Ltd., of Bedford and Northampton, was appointed, on July 1st, as technical adviser and aeronautical consultant to Philidas, Ltd., self-locking nut manufacturers, a division of Whitehouse Industries, Ltd., Ferrybridge, Knottingley, Yorkshire.

At Londonderry House, Park Lane, with the party in full swing. There were some 300 Royal Aero Club guests and foreign visitors.

(Below, left to right) with Lord Brabazon is Mr. Awadalla from Egypt. The Danish contingent included Messrs. Carl Dam, L. Mac Van Houen and Aage Gade. Among the French visitors who flew over were M. V. Rozier, M. and Mme. Robert and M. C. Koltjen.

AT THE INTERNATIONAL AIR RALLY BALL

(Right) Mr. Jacob and Mr. and Miss Dardignac ventured all the way from Oran to attend the Air Rally.

British rallyists are (left to right) Mrs. Lucas, Mr. and Mrs. Phillip Mayne, Mr. and Mrs. Martens, Miss Beardmore and Dr. Banks.

This happy group from Holland includes (left to right) Mr. A. H. Bottema, Mrs. Kries, Mrs. Versteeg and Mr. C. C. Kries.

SIKORSKY LECTURE

Enthusiastic Reception given to Helicopter Pioneer

Mr. Igor I. Sikorsky, helicopter pioneer and engineering manager of the Sikorsky Aircraft Division of the United Aircraft Corporation.

THAT the Helicopter Association of Great Britain would attend in force the lecture, "Helicopters in Peace and War," given by Igor Sikorsky on July 17th (under their ægis) was a foregone conclusion; but that the audience which packed the lecture theatre of the Institute of Civil Engineers would include so many eminent people in aviation was, perhaps, a little surprising. Certainly it revealed the widespread interest now being accorded the helicopter in this country, but chiefly it was that honour was being done to a pioneer—and what a charmingly modest and unassuming pioneer he is.

Mr. Sikorsky started his address by observing that the limitations to the upper and lower extremes of flight speed had at last been shattered with the coming of the supersonic aircraft and the helicopter, and of the two he did not think that the helicopter was any the less important. He then went on to read a number of statements made by high-ranking officers of the U.S. armed forces, testifying to the vital part played by the helicopter in the Korean war. Up to the present time, over 3,000 front-line rescues had been made by Sikorsky helicopters alone in Korea, and it was impressive in the extreme that, of all Allied aircrew shot down behind enemy lines in Korea, no less than 90 per cent had been rescued by helicopter.

Turning to the three questions of size, speed and configuration, Mr. Sikorsky gave it as his entirely personal opinion that there was no limit in sight to the size of the helicopter. Machines capable of carrying 20 to 50 passengers could be built now, and double this capacity could be achieved within a decade although, of course, if such aircraft were demanded as a military requirement, they could be produced very much earlier. On the score o speed, the lecturer divided helicopters into three types, the first of which was the ordinary, or classic, type in which all lift and propulsion was derived from one or more lifting rotors. For this type of aircraft, there existed a fairly well defined speed limit at *circa* 150-170 m.p.h. Rotor limits were imposed by compressibility effect on the advancing blade, and stalling of the retreating blade.

The second type was the compound helicopter or, as Dr. Bennett called it, the gyrodyne. This could be defined as an aircraft with a lifting and propulsive rotor supplemented by a wing and/or additional means of propulsion. This type of aircraft could conceivably achieve a speed of 200-250 m.p.h. fairly easily. These two types of helicopter were (thought Mr. Sikorsky) perhaps the most important. The third type was the convertible : that was to say, a machine which took off as a helicopter and then converted to a fixed-wing configuration. There were a great many designs in existence for such aircraft—it was easy on paper. The practical value of the type was, however, not very great in the lecturer's opinion, for it was for ever doomed to inefficiency, and this limited its field of application.

Mr. Sikorsky related his personal experience with his amphibians which, although good aircraft and very efficient, had to bear the payload penalty of an undercarriage, and this was sufficient to reduce profit-margin to such a degree as to result in the aircraft being doomed to failure in competitive operation. The moral was obviously that efficiency and lightness were prerequisites to success. To sum up the matter of speed, the capabilities of the "ordinary" helicopter up to 150 m.p.h., and the "gyrodyne" up to 200 m.p.h., were quite enough to justify the existence of the helicopter as a flying machine. For greater speeds than these, the obvious vehicle was the fixed-wing aircraft.

The matter of configuration was most controversial, but Mr. Sikorsky favoured the single rotor, and justified his preference by recalling that, in the early days of flying, the monoplane was used only for light weights, and heavier aircraft used more wings. We knew better today, and the lecturer thought that there was no insurmountable reason why a single-rotor helicopter of 250,000 lb weight, and with a rotor of 400 to 500 ft diameter might not ultimately be built. He wished to emphasize most strongly that there was no place for dogma in the helicopter field.

The immediate future would see helicopters capable of carrying 20-30 people, but the lecturer thought that the 10-20 passenger machines would define the border-line for multi-engined types. He dared to predict that (on the fixed-wing analogy) heavier disc loadings would come into general use—perhaps going up to as much as 10 lb—but that power loading would tend to go down, chiefly because power reserve was so much more important for the helicopter than for the fixed-wing aircraft. Rotor governors were not all that could be desired, but there was an important lesson in the fact that tests had proved that no governor, no matter how good, could work properly if the engine was too low-powered. On the other hand, an indifferent governor was capable of giving good results if the engine had an ample power reserve.

In conclusion, Mr. Sikorsky emphatically voiced his conviction that the helicopter was here to stay : it was the most universal vehicle used by man, and nothing could stop the immense development of this vehicle in the future—either in peace or war.

As Mr. Sikorsky sat down, he was accorded tumultuous applause, and when this had died down, the lecture was supplemented by two films. The first was a sound film, entitled *Operation Helicopter*, and this illustrated in a most convincing manner the many and varied duties being performed by helicopters in the Korean campaign : vital duties which simply could not be undertaken by any other means. There is no doubt whatsoever that Korean experience has established firmly and irrevocably the preponderant importance of the helicopter as a military vehicle. The second film—in colour—was "silent," but was accompanied by an extempore commentary by Mr. Sikorsky. The film depicted an S-51, fitted with amphibious gear, making autorotative descents on to a lake (with, apparently, the greatest ease), and then went on to show the most exciting pictures of an S-52 being flown in a quite superb fashion. The aircraft was pendulum-swung on to its nose and tail, at a height of about 50 ft; it did tight turns; it pirouetted about its own axis; and it looped. These aerobatics—for no other word does justice to the manœuvres—were spontaneously applauded by the audience. The film thereafter illustrated to advantage the carrying capacity of the S-55 by showing a column of ten armed troops filing into the aircraft which thereupon rapidly and neatly took-off.

The Discussion

Opening the discussion, Captain Smeeton, R.N., commented first on the high favour in which the helicopter was held by the Navy, and then went on to ask if Mr. Sikorsky could enlarge on his statements about transmission. One was continually told, by the protagonists of tip-drive, of the difficulties attached to transmission systems for helicopters of the large size that Mr. Sikorsky foresaw. The compound helicopter seemed to him (Captain Smeeton) to have some commercial advantages over the classic type, in that the limitations on tip speed of the classic helicopter might not appeal to some passengers. The classic type seemed ideal for city-to-airport traffic, and if this was so, he could see no reason why the type should ever be developed to a larger size. City-to-airport traffic would, surely, be restricted to the classic helicopter, and the compound type be utilised for medium distances.

In reply, Mr. Sikorsky said that certainly there were difficulties about transmission, but little was known of the difficulties and complications of other systems. The well-built transmission system could give excellent service, and was undoubtedly the most efficient way of transferring power from the engine to the rotor. On the analogy of motor-car gearboxes and differentials, there was no reason why an entirely practical and satisfactory transmission system, capable of several thousand hours' life, should not be built, and such a system would represent the most efficient type of transmission for a helicopter. Mr. Sikorsky did not think he could enlarge on the question of speed : it was in the hands of the operators, whether military or commercial. Nominally, speed had to be paid for with payload, and only the future could show to what extent the slower helicopters would be replaced by faster types : it was probable that both would survive for a long time.

Mr. N. E. Rowe (B.E.A.) said that British European Airways

SIKORSKY LECTURE . . .

had been experimenting with how to use the helicopter in transport. They had found it an excellent aircraft, and foresaw that, within ten years' time, the bulk of all (air) transport in this country would be undertaken by helicopter. We had the ideal conditions for it, i.e. large centres of population separated by comparatively short distances. Cruising speeds of the order of 150 m.p.h. could be expected, for experience had shown that with present cruising speeds the effect of head winds was great, and this made helicopter operation uneconomical.

Concerning the use of centre-drive and tip-drive, and the weights at which they would be used, he would like to ask if Mr. Sikorsky saw any difficulty in the transmission from turbo-prop-type engines. There were the problems of noise, gears and so on: there might be limitations to disc loadings for passenger transport; engine failure had to be catered for. These might have a strong bearing on the speeds which were practicable for cruising flight.

Mr. Sikorsky replied that he would repeat once more his complete conviction that a good, reliable and practicable transmission could be worked out. Present types were quite good, and the limit was in no way in sight. Practically all modern aircraft engines, and particularly turboprops, used transmission systems to the airscrew. There was no need to be overawed by the transmission problem; there were ways and means of designing reasonable transmissions with respect to weight; systems considerably larger than those at present in existence would certainly come. The future would show.

Turning to the subject of higher disc-loadings, Mr. Sikorsky agreed that, at the higher values, landings would certainly become more difficult: but even if high disc-loadings resulted in damage to the aircraft (in an emergency landing) they should not result in damage to the passengers. In the multi-engined helicopter, it might well be possible in such circumstances to reduce considerably the force of landing in precisely similar a way as applied to the large, multi-engined fixed-wing aircraft.

Mr. Raoul Hafner (Bristol Aeroplane Co.) said that nobody could be more satisfied than he to hear Mr. Sikorsky's opinion that helicopters had come to stay. He then went on to say that, after investigations, he had tentatively come to the conclusion that there was a tendency towards favouring tip-drive as a function of size. There was the limit imposed by tip speed, and it was patent that, as rotor diameter increased, r.p.m. went down, and the gap between engine speed and rotor speed became considerable for rotors of great diameter. Gears also became heavier as rotor size increased. Perhaps the very large rotors would be jet-driven, whilst the smaller types would be gear-driven; somewhere, there was a criterion of size, above which jet-drive would be used, and below which gear-drive would obtain. He agreed with Mr. Sikorsky that gearing problems were difficult but were not insurmountable.

Mr. Sikorsky replied that there seemed a certain limit beyond which tip-drive would become considerably more attractive than centre-drive. Where that limit would come was hard to say, but the sizes with which we dealt were considerably below that limit. For a really large helicopter, the transmission would probably not be of the kind we now knew. It might well be that the shaft would not carry torque but that, instead, a large gear might form the basis of the rotor hub, torque forces being directly transferred from gear to hub. It might be that the gear would be driven by (say) four pinions, each from an individual engine, through whatever reduction gears might be necessary. By incorporating a freewheeling unit close to each pinion, the loss of an engine would not affect the transmission, and the helicopter would still fly. In general, however, as size increased, there was no doubt that the preference for jet-drive would increase.

On behalf of the audience, Mr. Wigdortchik (B.E.A.) accorded an expression of thanks to Mr. Sikorsky. Throughout aviation, he had been a leader, and now the fruit of his life's work was beginning to show itself: they could not hear from anyone in a better position to put the helicopter in true perspective.

EXHAUST GAS ANALYSIS

A NEW line of attack is now being taken by Armstrong Siddeley Motors, Ltd., on the difficult problem of determining the optimum combustion efficiency of a gas turbine. It has long been known that analysis of the exhaust gases of an internal combustion engine can give a direct indication of the combustion efficiency, and Armstrong Siddeleys are now applying this technique to the gas turbine. Samples of the exhaust gas are taken during flight tests, and are then sealed in special containers for subsequent analysis in the laboratory. From these samples an accurate estimation can be made of the combustion efficiency under various engine operating conditions, and, although it is early yet to prophesy the degree of improvement that may be expected from this new test development, there is little doubt that it can result only in advantage to the performance of the engine.

NEW RUSSIAN HELICOPTERS DEMONSTRATED AT TUSHINO DISPLAY

This photograph, secured at the Soviet Aviation Day display at Tushino Airport, Moscow, on July 9th, is of unusual interest not only in providing the first views of a new type of Russian helicopter now in service, but in coinciding with our report, on this and the previous page, of Mr. Igor Sikorsky's paper "Helicopters in Peace and War." It will be seen that the Russian machines have certain features in common with Sikorsky and Bell types, and with the Bristol 171. They are apparently used for military purposes.

TRANSFORMABLE DELTA PROJECT

A Proposal by Professor G. T. R. Hill

By GRENVILLE MANTON

THE advantage to an aircraft of the widest possible speed range is obvious, and recently a great deal of interest has been occasioned by the first illustrations of the American Bell X-5. This aircraft is unique in having wings of which the angle of sweep-back can be varied in flight. In this country research at the high end of the speed-scale is being conducted to an increasing extent with the aid of three delta-wing designs—the Avro 707, Boulton Paul III and Fairey F.D.1.

A design even more unconventional than the Bell X-5 and the subject of a British patent, is also being studied in this country. It seeks to provide for the widest possible speed range, or, more particularly, the advantages of delta configuration at the high-speed end of the scale without the usually associated fast nose-up approach and touch-down qualities. Blackburn and General Aircraft, Ltd., have under consideration this transformable delta-wing project, the preliminary design of which is the work of Professor G. T. R. Hill, professor of mechanical engineering at University College, London, and better known in aviation circles as the eminent designer of the small Pterodactyl which, with its 32 h.p. Bristol Cherub engine, was the precursor of the Westland-Hill tailless fighter with 600 h.p. Rolls-Royce Goshawk engine, constructed some sixteen years ago. Even before that time Professor Hill had studied the problems of what we now designate "supersonic" flight, and had pointed out in lectures the probability of the sonic "barrier" being a formidable factor with which designers would one day have to contend in producing aircraft capable of great flight speeds.

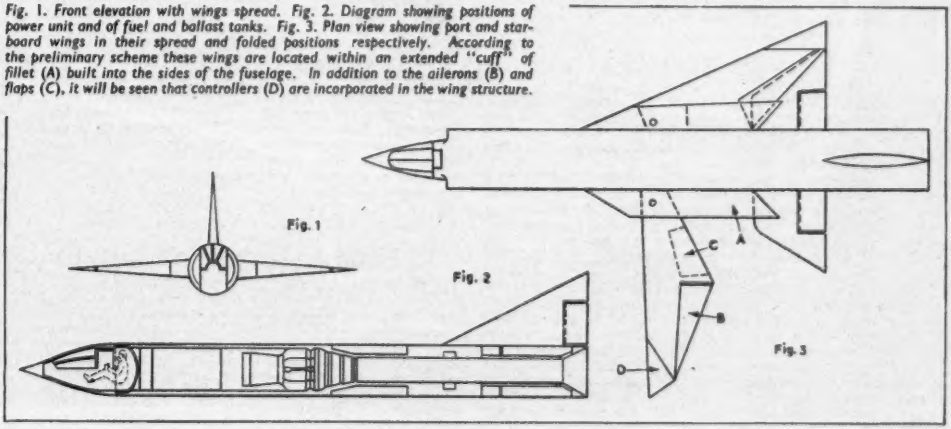
In his delta-wing plan (with which the Blackburn and General Aircraft Company is now associated) Professor Hill's chief object is seemingly to evolve a wing arrangement whereby not only will drag be reduced to such an extent that the machine will be able to fly at speeds well into the sonic range, but the concomitant of high take-off and landing speeds will be eliminated. To achieve this he proposes to employ a main wing and a subsidiary wing together mounted on the fuselage in such a way that the main wing, which is hinged at the root, can be swung back to a position where it marries with the subsidiary wing to form a continuous lifting surface of delta shape. When the main wing is in the forward position it is separated from the subsidiary wing and assumes a substantially conventional straight-wing planform, whilst the subsidiary wing serves as the tailplane. It should be possible for the wing to be given lift characteristics and lateral control media such as are to be found in conventional aircraft and the subsidiary wing, for service as the tailplane, could be fitted with the usual type of elevators. These factors, combined with the increased lift coefficient, should enable the pilot to land the machine and retain adequate control at reasonably low speeds when the main wing is in the "straight" position.

With the wing swept back to produce the delta configuration for high-speed flight, the ailerons, owing to the wing "nesting," are inoperative. They are, in fact, locked, and lateral control is obtained through the employment of deflectable surfaces at the wing tips. Professor Hill suggests that a more or less orthodox type of fin and rudder might possibly be incorporated; it was, however, not certain that they would be necessary, particularly for high-speed flight, because it might well be possible to provide adequate directional and lateral control through differential operation of the tip control surfaces. He also calculates that the elevators, which would be used in the normal way when the main wings were spread for low-speed flight, might be used solely for trimming purposes when the machine assumed the delta form and their normal function of control in the pitching plane be taken over by the tip control surfaces. Presumably this assumption, together with many others, is based on Professor Hill's valuable experience with the control system and flying characteristics of his Pterodactyls.

The position of the main wings could be altered by electric, pneumatic or hydraulic servo motors, or by aerodynamic means: the matter is not critical. Each wing could be given a predetermined incidence and dihedral setting when in the spread position and this could easily be governed by an inclination of the wing-root hinge axis. Changing of wing position might conceivably be brought about by using part of the aerodynamic load as a force vector to move the wings automatically.

Obviously, the amplitude of wing-position change in this aircraft would have a major effect on the centre of gravity and some means of compensation would have to be applied. Professor Hill visualises the adoption of a fuselage of tubular form so that fuel tanks of the same shape and size could be accommodated fore and aft of the turbojet which would be installed amidships. By this means adequate longitudinal trim and stability could be obtained by transferring part of the total fuel supply from the forward tank(s) to the rear tank(s) or vice versa. This effective weight transfer would be done by pumps when the wings were swept back to give the high-speed delta form and, when the wings were spread

Fig. 1. Front elevation with wings spread. Fig. 2. Diagram showing positions of power unit and of fuel and ballast tanks. Fig. 3. Plan view showing port and starboard wings in their spread and folded positions respectively. According to the preliminary scheme these wings are located within an extended "cuff" of fillet (A) built into the sides of the fuselage. In addition to the ailerons (B) and flaps (C), it will be seen that controllers (D) are incorporated in the wing structure.



TRANSFORMABLE DELTA PROJECT...

for landing condition, the pumping process would be reversed. Ballast tanks might be an additional requirement.

Two important features which are envisaged in this project are (i) a jettisonable capsule-cockpit which, in an emergency, could be separated from the fuselage to descend by parachute, and (ii) the "arched" dihedral of the delta wing form. This would provide a cambered aerofoil section in the line of flight when the wings were spread so that a greater lift coefficient at higher angles of incidence would be available.

This Blackburn-Hill delta-wing project is the subject of recently granted patents. The revolutionary nature of the initial design is, perhaps, equalled only by that with which the Société Générale de Méchanique-Aviation-Traction (Matra) became associated last year. This was the Matra R-130, a machine designed for supersonic flight. One pair of wings was provided for subsonic flight and another for trans- and supersonic flight. Each pair was arranged at right angles to its complement, and, for the take-off, the supersonic surfaces would lie in the vertical plane. On the speed nearing Mach 0.65, the pilot would roll the aircraft through an angle of 90 degrees so that the sustentation would be taken over by the supersonic wings and the (now vertical) subsonic wings would be retracted into the fuselage. Incorporated in this extraordinary, not to say bizarre, design was a rotating cabin so arranged that in the 90 degree change-over the pilot would remain in a normal position. The general scheme advanced beyond the drawing-board stage and some tests were made in the wind tunnel at Chalais-Meudon but for financial reasons the project was subsequently shelved.

CAN FISHES FLY?

Observation Versus Theory

By L. W. CRAWFORD

THE answer to the title query, in spite of unanimity of biological opinion to the contrary, is that they can, and they do.

Very shortly after the last war I found myself in charge of a hangar full of rice, the air engineer officer of an aircraft carrier, on its way to the relief of Hong Kong.

Having no aircraft to occupy my time and being a staunch teetotaller, I amused myself by watching the antics of the flying fish, otherwise known as *Exocoetus* and *Dactylopterus*. I had previously been under the impression that these creatures could not fly in the accepted sense; the biological boffins seem unanimous in propounding the theory that a flying fish "glides" through the air. No book I have yet seen gives this fish, Nature's aerial submarine, credit for being able to undertake a powered flight : and yet I have seen them leap out of the ocean to a height of only two or three feet, and keep airborne, executing turns the while, for distances of at least a hundred yards.

This order of "glide," of course, indicates a lift-drag ratio far in excess of that possessed by the most efficient sailplane, and although I have never introduced a petrified flying fish into a wind-tunnel and measured its L/D characteristics, it needs but a brief glance to see that its aerodynamic efficiency as a glider cannot be very great. If a fish were to glide only fifty yards from a height of three feet, its angle of glide would be as little as one degree and a few minutes. A study of the picture of a flying fish in any encyclopedia soon convinces one that here is no layout for glides of anything approaching such efficiency.

On a more recent voyage through regions "where the flying fishes play," I was assured by the ship's Chinese butcher that on calm nights the sailors put a lamp on the lower deck. The flying fish, attracted by the light, zoomed up over the rail and were shortly lamenting their recklessness—in a frying pan. They taste like herring, I understand.

Now if these fish can remain airborne for such long distances and also climb in over a ship's rail, then it is unquestionable that they must use power for flight. Yet first appearances are against this because, on emergence from the water, the modified fins appear to cease vibrating and, of course, R.P. and jet propulsion are not evident. I say "appear" advisedly, as will shortly be made clear.

Before suggesting the actual means of propulsion let me quote an authority. Perhaps the reader can make sense of the following; I cannot. "The long pectoral fins, acting when distended as parachutes, rather than as wings, sustain them in the air against the wind, sometimes for five hundred feet."

As the result of long observation (both by myself and a friend) sometimes with binoculars, sometimes without, I have come to the conclusion that flying fish carry out powered flights of varying duration up to distances of over a hundred yards. The manner in which this is done is as follows : The fish emerges from the water with a visible and violent beating of its wings, or modified fins. (The size of these appendages must be a compromise to suit the different densities of water and air. A large wing suitable for bird-like flight would be useless under water.) Immediately after emergence from the water, the small wings change their comparatively slow vibration—which was suitable for driving the fish from the water—into a frequency similar to that of an insect; so fast, in fact, that one gets the impression that the motion has ceased altogether. Certainly, the wings are still visible, but they are definitely blurred in outline.

Proceeding like this, the fish has a vertically sinuous flight-path, rising and descending to clear wavelets, and also, occasionally, makes small and erratic turns. Finally it plops, usually making a "belly-smacker," back into the water again. The disappearance is always sudden and the wings are outstretched as the fish goes under. The effect is rather as if power had suddenly been cut off and a free fall made into the water. My co-observer and I are both of the opinion that the wings take on a sharp outline immediately before the fish falls, as if vibration had suddenly stopped.

In conclusion, although it must seem impertinent of a mere layman to contradict established biological opinion, I claim that I have, at least, the backing of the simple laws of physics, but the biological gentlemen's explanations . . . well, read the above quotation again.

OXYGEN AND NITROGEN PLANTS

AIR-SEPARATION plants for the production of oxygen, nitrogen and rare gases such as argon are described and illustrated in a new brochure published by the low-temperature division of Petrocarbon, Ltd., 170 Piccadilly, London, W.1, and Urmston, Manchester.

Four basic types of equipment are described. The "R" type are small plants to supply liquid nitrogen for use as a low temperature refrigerant in research laboratories. They are available in two standard sizes, producing respectively 8 and 24 litres per hour of liquid nitrogen of 99.5 per cent. purity or over.

Type "S" are small gaseous-oxygen plants to supply gas (usually charged into high-pressure cylinders) for welding and allied processes. There are two standard sizes, producing 7 and 20 cubic metres of 99.5 per cent. oxygen per hour (250 and 700 cu ft/hr) reckoned at atmospheric conditions.

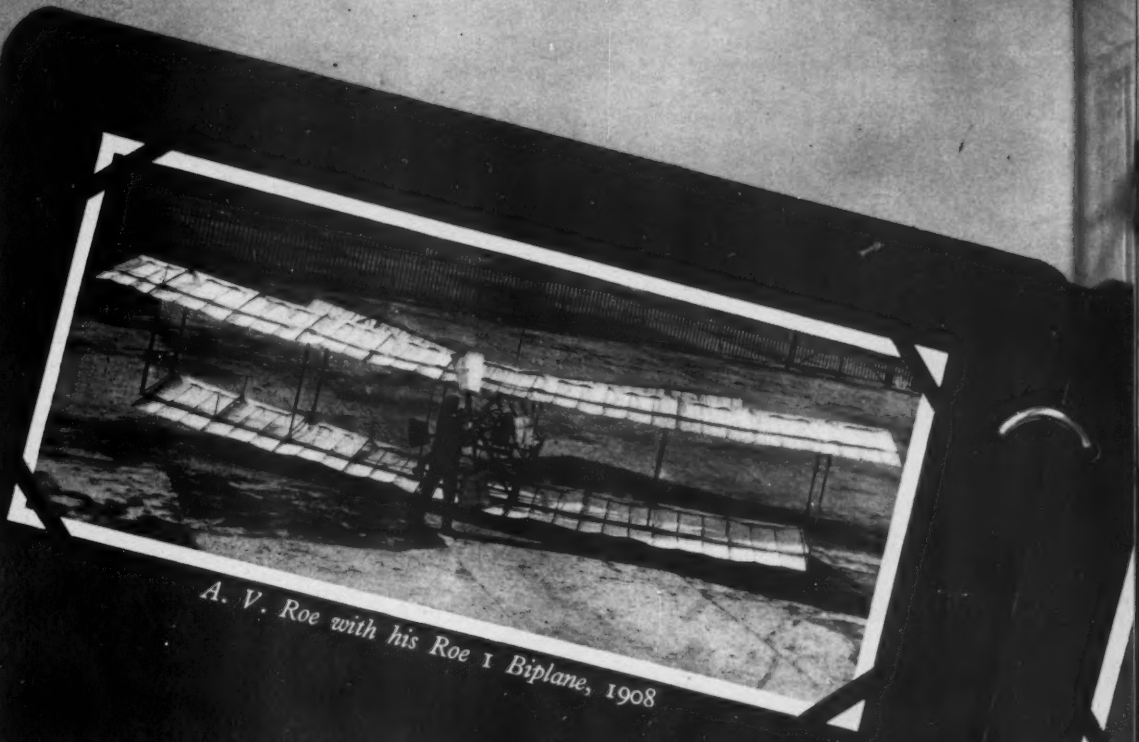
The larger "D" type are medium-sized oxygen or nitrogen plants and, whilst not being quite so simple or compact as the type "S" plants, are more economical in power consumption. There are two standard sizes, producing 30 and 71 cubic metres of 99.5 per cent. oxygen per hour (1,060 cu ft/hr and 2,500 cu ft/hr) or 127.5 and 285 cubic metres of 99.9 per cent. nitrogen per hour (4,500 cu ft/hr and 10,000 cu ft/hr). Larger-capacity equipment can be supplied to order.

Fourthly, there are the type "T" large-capacity oxygen and nitrogen plants for production of upwards of 200 cubic metres of oxygen or 800 cubic metres of nitrogen an hour. Designed to individual requirements, they are stated to offer maximum possible economy in operation.

CANADIAN SOUND SUPPRESSION

IN an attempt to reduce the noise level of engine runs, Avro Canada have installed new sound-suppression equipment in their turbojet test houses. These exhaust mufflers consist of metal tubes suitably lined with material which will absorb objectionable noises. The usual water cooling system has been replaced by supplying about ten tons of air per minute to each muffler. The primary reason for this decision is that each jet unit in operation would require more water for cooling than is needed for the remainder of the plant.

43 years of progress



A. V. Roe with his Roe I Biplane, 1908

A. V. ROE & CO. LTD., MANCHESTER *Member of the Hawker Siddeley Group*

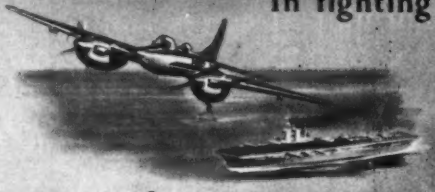
AVRO

In commercial service
from up-country charter to world trunk routes

In Transport and Coastal Commands

In civil and military training

In fighting and bombing



In ocean operations from ship and shore

In every functional capacity where propellers are used

DE HAVILLAND PROPELLERS

are pulling the loads

NORTH POLE MET

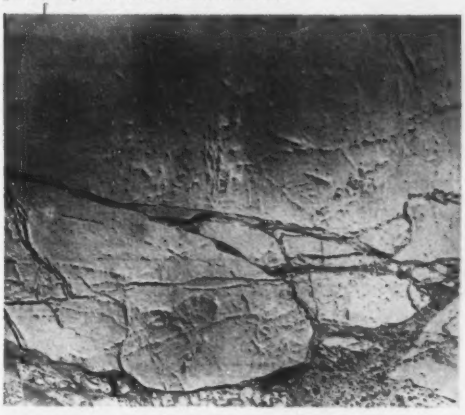
Polar Reconnaissance Flights as Daily Routine

According to the record on its nose, this B-29, "Lonesome Polecat," has already completed 30 Polar flights.

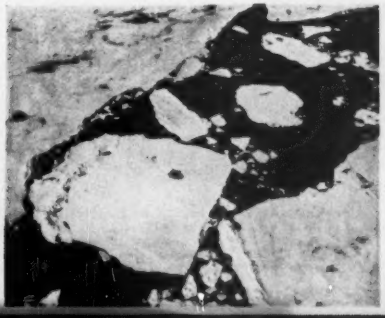
THE presence in Arctic seas of two large floating islands which could possibly afford bases for semi-permanent meteorological camps was recently revealed by Lt.-Col. Joseph O. Fletcher, commanding officer of the 58th Strategic Reconnaissance Squadron, U.S.A.F. He was speaking before the Research and Development Board of the U.S. Defence Department in Washington.

One of the functions of the 58th Strategic Reconnaissance Squadron is to supply meteorological information to a central weather bureau. The aircraft used are modified B-29s, each with a crew of 14, all of whom have received training in Arctic survival methods. At 7 a.m. every day, one of these aircraft, weighing between 130,000 lb and 134,000 lb, takes off from the squadron base at Eielson, Alaska, with 7,800 gallons of fuel and two tons of survival equipment aboard. Before returning to base 16 hours later, it will have flown 3,500 miles, spending five hours over "land" and 11 hours over icy seas.

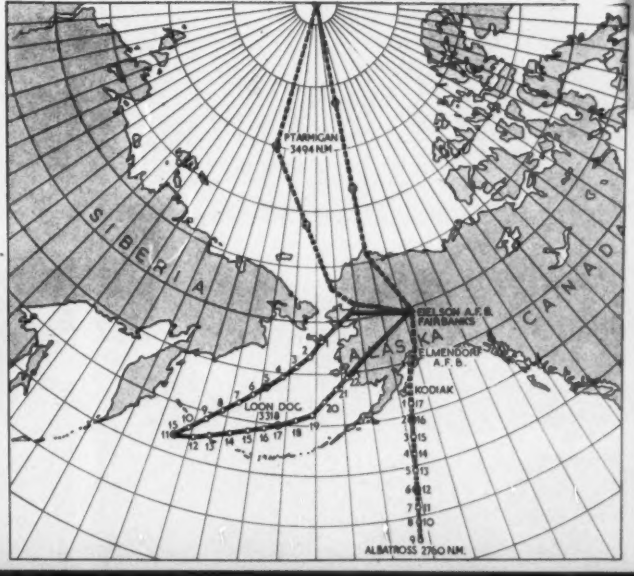
From Eielson, the aircraft heads towards Point Barrow, thence flying over Brooks Range, and on to the North Pole; the return journey is made via Point Hope in Alaska. After crossing the Bering Straits, a slow let-down is made, calculated to bring the aircraft over Fairbanks at 2,000ft. During the flight, each member of the crew has the task of supplying meteorological information to the radio operator, who transmits it to the ground station at Point Barrow at half-hourly intervals. There is little doubt that these daily reconnaissance flights by the 58th Squadron assist the work of meteorologists considerably, for data are now regularly gleaned which previously have been rather limited.

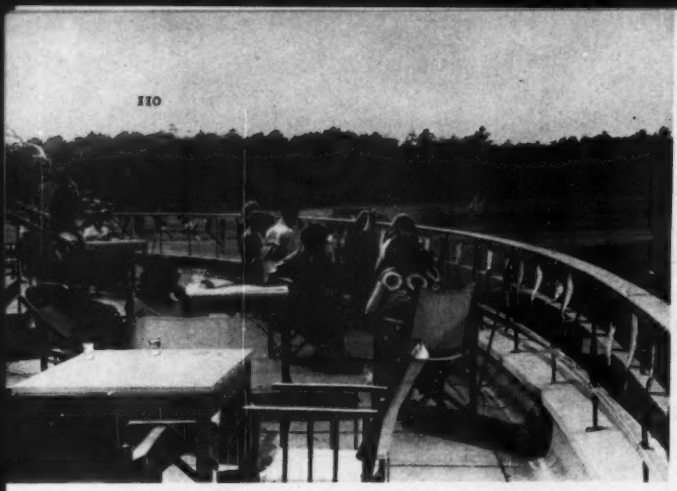


(Below) Brooks Range seen from an aircraft heading toward Point Barrow on the North Alaskan coast. (Bottom left) An ice-flow photographed from low altitude about 15 miles from the Pole.



The North Pole as seen from 18,000ft. (Below) Map showing a number of reconnaissance tracks, among them the "Ptarmigan" track to and from the Pole.





The terrace of Gatwick's terminal building made an admirable grandstand from which rallyists kept a critical eye on other "arrivals."

Gatwick, with the visitors taking up their "on-parade" positions. This photog

HORS-D'ŒU

Aircraft of many types and nationalities arri

Illustrated with "

From Switzerland came M. and Mme Perrier in their trim little three-seat Piper Super Cruiser.

Twenty years with the same owner is the record of this sturdy Junkers Junior two-seater, which flew in from Finland.

Two of these rugged Ercoupes came from Holland; the charming passenger of this one had Mr. Van der Drift as her pilot.

FROM the balmy sunlight of Continental skies into the dull, translucent cloud-mass which all too often hovers over our own countryside in summertime, there came last week a veritable gaggle of light aircraft. Like so many migrant geese, they crossed the coast at a number of points, all heading for a common destination. Their goal, Gatwick; their intention, to participate in the International Invitation Air Rally organized by the Royal Aero Club.

In a varied assortment of aircraft almost one hundred rallyists arrived from seven European countries, while one really ardent rally fan even braved the distance from Oran to Gatwick in a very travel-worn Fairchild Argus. From one o'clock onwards a steady multi-coloured stream of Austers, Cessnas, KZIIIs and VIIs, Fairchilds and other makes of machine touched down on the grass runway and were marshalled rapidly to the Customs inspection area.

On arrival they were met by Colonel Preston and other officials of the Royal Aero Club, and entertained in the reception room on the terrace of Gatwick's imposing terminal building. The pity was that there was no sunshine, but the speedy dispensation of refreshment to needy travellers did much to compensate for the weather's inhospitality.

Although a total of 47 aircraft was expected, only 35 had turned up at the end of the afternoon. Apart from the inevitable last-minute cancellations, one or two machines were apparently delayed *en route*. One expected V.I.P. who

The single-engined pusher-type Courlis is rarely seen in this country. The two onlookers appear intrigued by the arrangement of its cooling fan.

was secured by the kindness of Olley Airways, Ltd., who lent us their Proctor.

RES VARIÉS

at Gatwick for the U.K. International Rally

ght" Photographs.

did not arrive was His Excellency the Duke of Almadovar del Rio, president of the Spanish Royal Aero Club.

Walking round the line of parked aircraft, we saw several interesting machines which are rarely seen in our skies. One was the gallant old Junkers Junior two-seat monoplane, which, in this case, had been in possession of its owner, Major W. Bremer, since 1931; it had flown from Finland for the occasion. The unconventional Courlis, a high-wing single-engined pusher, had flown in from France. Two Ercoupes were among the Dutch contingent, while a Navion turned up from Belgium.

In order to get a really good view of the whole proceedings we made a couple of quick circuits of the airfield in a Proctor, kindly made available for us by Olley Airways, Ltd. Seen from the air the array of visiting aircraft appeared even more colourful than when viewed from the ground.

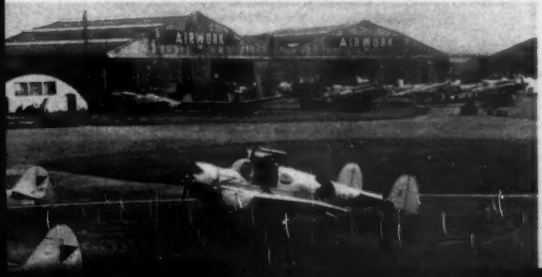
When all visitors were deemed adequately refreshed they were driven to London in three specially chartered coaches. In the evening they were guests at the Rally Ball, which took place at Londonderry House. On Thursday they were entertained to lunch at the Festival Hall before visiting, in the afternoon, the "Fifty Years of Flying" display at Hendon. Enplaning in their own aircraft at Gatwick the following day the guests then set a northerly course for Sherburn-in-Elmet (Leeds), where they were made at home by the Yorkshire Aero Club.

A temporary haven for hungry fliers was established in the terminal building—and very well patronized it was.

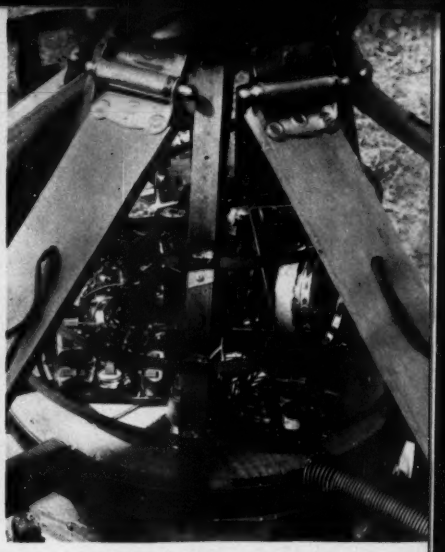
Several Cessna 170s were among the visiting machines. Of particular interest in this type are the unbraced spring-steel undercarriage legs.

About to alight from their Ryan Navion after flying from Belgium are M. and Mme Gillon.

One of several of its type was this K.Z VII from Denmark.



Any thoughts of war, evoked by the Spitfires passing through Airwork's hands, are dispelled as M. and Mme Rozier alight from their Gemini.



On the left the Grasshopper is seen ready for operation; the telescopic mast is about 20ft high. The centre view shows the device after it has landed, but before the leg-release device has functioned. On the extreme right is an interior view, with the clock mechanism in the right foreground.

Air-Launched Weather Station

Ingeniously Designed Equipment for U.S. Navy

A SELF-CONTAINED automatic weather station, which transmits weather data by radio, has recently been developed by Percival D. Lowell and William Hakkarinen of the U.S. National Bureau of Standards for the U.S. Navy Bureau of Ships. Named the Grasshopper, the device can be parachuted from aircraft on to inaccessible territory. It will automatically set itself up and periodically make and transmit weather observations. It may also be used as a radio marker beacon.

Designed in the shape of a bomb, and packing its own parachute, the Grasshopper is loaded on a bomb carrier. When the unit is released, the parachute is automatically opened by a static line; simultaneously, an electric clock, which controls subsequent operations of the station, is turned on. The impact of landing sets off a small explosive charge which disengages the parachute and prevents the station from being pulled along the ground. Either immediately or after a pre-set dormancy period, another explosive charge causes the station to rise to an upright operating position. This is done through an arrangement of six legs to which springs are attached; the explosive charge operates a release, permitting the springs to pull the legs into position. A third explosive charge extends a telescopic vertical antenna to a height of some 20ft. The station is then ready for automatic transmission at intervals predetermined by the built-in timing mechanism.

The Grasshopper could be adapted to transmit various kinds of information, but in the standard design only temperature, pressure, and humidity data are reported. Separate mechanisms responsive to changes in these atmospheric conditions each cause an associated resistor to vary. At predetermined intervals the timing mechanism turns on the radio transmitter and connects one resistor after another to a critical point in the transmitter circuit. The transmitter is designed so that the emitted radio signal pulses on and off at a rate proportional to the value of the resistor so connected. The station is calibrated before use by subjecting it to known temperatures, pressures, and humidities and measuring the resulting pulse rates. At the receiving station the transmitter pulse rate can then be read as temperature or humidity, depending on the phase of the predetermined clockwork cycle.

The radio transmitter proper consists of a crystal oscillator followed by a radio-frequency amplifier stage. A relay in the plate circuit of a separate relaxation oscillator turns the crystal oscillator on and off at a rate proportional to the value of whatever resistor is temporarily inserted (by the clock mechanism) into the relaxation oscillator circuit. When the station is to be used as a beacon, the radio transmitter and its control mechanisms may, of course, be simplified.

The clock, in addition to inserting the several weather-responsive resistors into the circuit in a predetermined sequence, connects two other resistors at appropriate intervals. These are a reference resistor and an identification resistor, both of constant value. The pulse rate produced by the fixed reference resistor is observed during initial tests of the transmitter. Any subsequent deviation in the reference resistor pulse rate warns the receiving station that a correction factor must be applied to pulse rates of the weather-responsive resistors. Such deviation could arise from transmitter damage or aging. The identification resistor is of a value selected to produce a pulse rate characteristic of the particular station; this enables the receiving station operator to identify the station.

A special technique is used to ensure maximum accuracy of the transmitted data despite possible deformation of the weather-responsive mechanisms due to landing impact; a buzzer vibrates each weather-responsive device for a short time before its associated resistor is inserted in the relaxation oscillator circuit. This forced vibration counteracts friction, which may have been increased by landing impact deformation, and thus aids in the attainment of a true equilibrium condition.

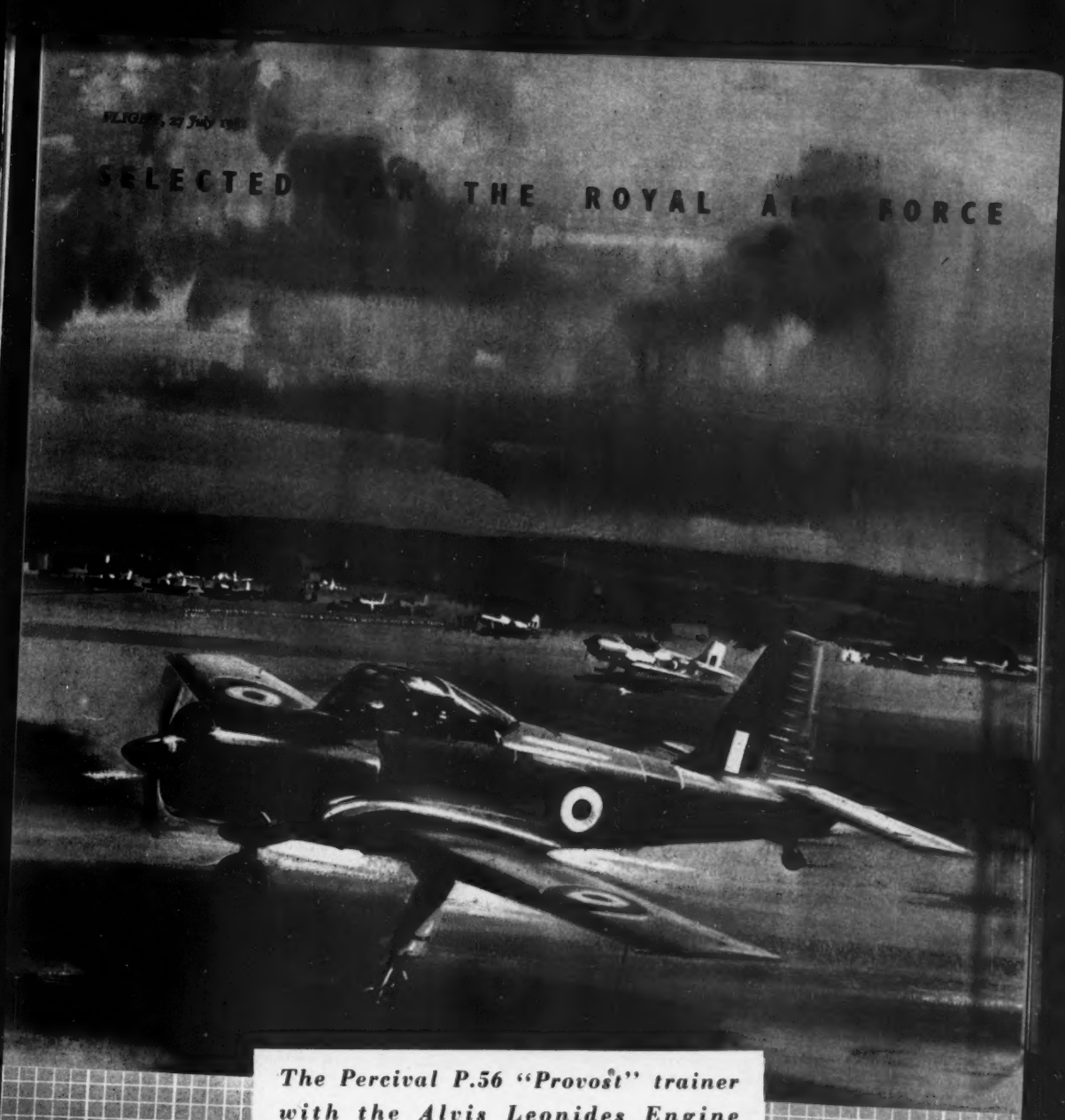
The developmental model had an output of the order of 5 watts. Operating on a frequency in the neighbourhood of 5 megacycles, it performed reliably over land at ranges of more than 100 miles. The dry batteries used provided power for transmission of weather reports at three-hour intervals for more than 15 days.

RUSSIAN GLIDERS IN GERMANY

A CORRESPONDENT reports that a few days ago, in the very early morning, three Li-2 (Russian-built Dakota) glider tugs crossed over Zehlendorf, south-west of Berlin in the American sector. They were flying at about 1,500ft and one of these machines was towing a large glider, the span of which was slightly more than that of the Dakotas, though the fuselage was shorter. The same correspondent believes that Russian paratroops are training at Stendal, near the frontier of the British Zone.

FLIGHT, 27 July 1950

SELECTED FOR THE ROYAL AIR FORCE



The Percival P.56 "Provost" trainer with the Alvis Leonides Engine

ALVIS

LEONIDES

ALVIS LIMITED, COVENTRY, ENGLAND

THE PERCIVAL P.56 "PROVOST"

SIDE-BY-SIDE TWO-SEAT BASIC TRAINER

(Leonides Engine)

SELECTED FOR THE ROYAL AIR FORCE

". . . it remains only to be said that the Boscombe Down report on the aircraft was such as to be fairly described as eulogistic, the rate of roll (about 90 deg/sec) and the aileron response, in particular, being extraordinarily good. In the P.56, therefore, it would seem that the Royal Air Force can look forward to having a basic trainer which, for its designed sphere, is without doubt at the moment unrivalled." *"Flight" May 4th, 1951.*

PERCIVAL AIRCRAFT LTD., LUTON, BEDFORDSHIRE, ENGLAND and at TORONTO, CANADA.

A Hunting Group Company

EVOLUTION OF THE GUIDED MISSILE

Part V:

The New Instrument (Continued)

By KENNETH W. GATLAND

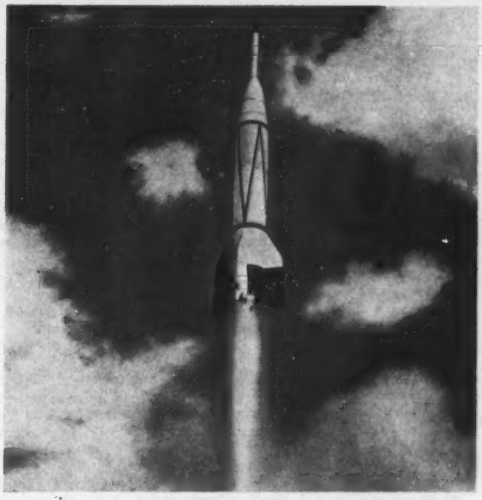


Fig. 25. Take-off of the A-4 WAC-Corporal combination rocket. The final step reached a summit altitude of 250 miles.

IN the first part of this article, in our issue of May 4th, the author discussed general aspects of his subject and reviewed certain rocket-propelled ground-to-air missiles; Part II (May 18th) went on to discuss air-to-air missiles and rocket-driven intercepters. The third instalment (June 29th) reviewed the development programme carried out by the Germans with the A-4 ("V.2") rocket and its projected derivatives. In Part IV, and in the present instalment, Mr. Gatland deals with the use of rockets as instrument carriers for high-altitude research. A final instalment remains to be published.

DESPITE the large number of rocket firings that have already taken place in the U.S.A., the work of analysing the atmosphere and obtaining properly integrated results over large areas will involve years of further experiment with the Aerobee and similar vehicles. There will generally be little need for soundings to exceed an altitude of 100 miles.

It is, nevertheless, a definite policy to extend rocket flight beyond the atmosphere, and individual experiments may be expected which seek to project recording instruments extreme distances away from the earth. In February 1949, for example, the first demonstration was given of a high-altitude step-rocket when the A-4 was used as a booster for WAC-Corporal (Fig. 25). The resulting climb of the final step to a point 242 miles from the earth's surface gives an indication of the vast possibilities which now exist.

This impressive experiment was heralded as the first positive step towards the establishment of a small "satellite" rocket in a permanent orbit around the earth. The intention of the United States Government to develop such vehicles had been soberly announced to Congress a few months earlier by the Secretary of Defence. It was revealed that investigation into the design of close-orbit satellite rockets had already been in progress two years, and that although the work was in an early formulative stage, it was being carried out independently by each military service under the direct supervision of the Committee on Guided Missiles. The announcement brought immediate reaction from the popular press in the shape of features depicting elaborately equipped "space-stations." There were also some hastily conceived ideas concerning how such a vehicle would maintain its position in space without falling, the choice invariably being between (*a*) "it is held at the *perimeter* of the gravitational field" (whatever that may mean!) and (*b*) "at a distance of 200,000 miles, a neutral point is reached where the body will be unaffected by the gravities of the earth and the moon."

In fact, neither explanation is correct. The case is simply that if a rocket is projected outside the atmosphere, turned into a plane which is tangentially normal to the surface, say at 500 miles altitude, and driven up to a speed of approximately 4.6 miles/sec., it will remain circling the earth as obediently as any planet circles its sun. If the rocket is travelling 500 miles above the equator in the same direction as the world is rotating, it will complete one circuit roughly every 107 minutes.

The balance is struck between the motion of the rocket and gravity which combine to bring the vehicle round in a curve which, at the particular velocity and height envisaged, corresponds with the curvature of the earth. As space offers no resistance, the vehicle never loses speed and becomes an artificial "satellite." The rocket's velocity tangential to the surface is equal to $\sqrt{gr^2/s}$, where g is the mean gravitation of the earth, r the radius of the earth, and s, the distance of the rocket from the earth's centre. A point of further interest is that if the orbital height were 22,200 miles, the vehicle would remain "fixed" in the sky, making one revolution with the earth every 24 hours (at 1.9 miles/sec).

The programme in America to develop such "satellites" was initiated in 1946 following the examinations of Peenemunde and other rocket research centres throughout Germany, and through the interrogation of prominent technicians by United States and British Intelligence teams. A research pool, known as the RAND Project (later the RAND Corporation), was established, combining the resources of the Douglas Aircraft Corporation, the Armed Forces, and certain selected research establishments, specifically to pursue this work.

There is, of course, considerable secrecy surrounding the activities in America, and nothing is known of progress towards the design of an orbital rocket. It is evident, however, that the first example of such a vehicle will be a step rocket with a very modest instrumental payload, possibly to reach its orbit at between 400 and 500 miles. The many practical problems accompanying its design are already receiving detailed consideration, and as these are of a fundamental scientific nature, some relevant reports are actually being published. One is a comprehensive theoretical analysis of the nature and extent of the atmosphere.

The importance of such investigation is obvious, for the orbital rocket is effective only in its location "outside the atmosphere." The vehicle will exist as a satellite without expenditure of power only when there is no drag along its orbital path. Whereas the density of the atmosphere may be insignificant on the flight of an interplanetary rocket because of its small transverse time, the orbital rocket will travel for months, even years, on the same path and even an infinitesimal atmosphere would have an accumulative effect on the missile which might be sufficient to upset the orbital balance and ultimately cause its return to earth.

Stage two beyond the orbital rocket will probably be a guided missile either to strike the moon's surface or, more

Evolution of the Guided Missile . . .

sensibly, to take up an orbital path around it. The latter result would, of course, be more exacting in the control technique, but nevertheless infinitely more worthwhile as a scientific experiment. It may even be possible, with comparatively light equipment, to transmit radio-pictures of the lunar surface back to the earth, including large areas which are hidden from our direct view. However, this interesting prospect is not likely to arise very early in the development of space-missiles, because of the heavier payload and the delicate control and telemetering techniques involved.

In developing any study of space-flight, one is often confronted by questions which to the layman must seem the last word in logical contempt. How, for example, can we discuss so calmly a moon-flight extending 240,000 miles when the farthest we have so far been able to project a rocket is 242 miles? Clearly, to the uninformed, this does appear a most plausible argument. With space-flight, however, one must emphasize that, given unlimited time, it is not *distance* that matters but *velocity*, for a rocket that can attain a minimum of 7 miles/sec, will defeat the earth's gravity and never return.

This velocity can effectively be built up by using a series of chemical step rockets. The booster steps jettison progressively, contributing a high fraction of escape velocity to the small instrument rocket in the nose which achieves final release from the earth. Having served their purpose in building up *velocity*, the boosters drop back to the ground. Meanwhile, the final step will coast on across space without any further expenditure of energy.

A paper by the American investigators Malina and Summerfield has shown that escape velocity can be obtained by guided-missiles with any number of the available propellents by proper choice of the number of steps. As an example, an acid-aniline rocket having a gross mass of 823,000 lb, and consisting of five steps, could project away from the earth a payload of 10 lb. Alternatively, an acid-aniline rocket having ten steps could produce the same result for a gross mass of 136,000 lb. In both these cases, the structural factor $\frac{\text{Structural wt.}}{\text{Structural wt.} + \text{propellent wt.}}$ was taken as 0.20. Proportionately better initial take-off masses are derived in other selected cases using oxygen-ethanol and oxygen-hydrogen in which, incidentally, for the latter, the structural factor was increased to 0.33.

The instrumental device proposed, which it was thought could be built within the 10 lb limit, was a small radar-beacon transmitter and an electrical pick-up for measuring a single quantity—cosmic ray intensity, for example. Radar signals could be sent to the rocket during flight by means of a ground transmitter similar to that which has already been used to reflect back echoes from the moon. The radar beacon in the rocket's final step is intended to "reflect" the signal back to the receiver on earth to provide data on the missile's trajectory. The values of cosmic ray intensity taken during flight could be incorporated in the return signal.

This possibility alone puts an excellent case for the early development of extra-terrestrial missiles, and with the further prospect of a light solar-regenerator, converting solar heat to electrical energy in a continuous operating cycle, transmission between the rocket and the earth should be possible over much longer periods.

First, however, must come the non-returning earth satellite vehicle, and useful information on radiation phenomena should be obtained by a similar system of transmission, to provide, for example, a check on the periodic rise and fall in the intensity of cosmic and ultra-violet radiations. Even the initial results will have much more than academic interest and indeed are likely to bring immediate benefits in the fields of electronics and meteorology.

Finally, to take the case of an oxygen-hydrogen "escape" rocket with this same 10 lb payload, we find that with five steps the take-off mass reduces to 8,320 lb. This reduction

Fig. 26. The "close-orbit earth satellite rocket" described in this article. Constructed in three steps, with expendable tanks, the gross mass would be approximately 325,000 lb, and the instrumental payload 110 lb.

in mass as compared with the acid-aniline five-step rocket (823,000 lb gross) emphasizes the importance of developing practical high-performance rocket systems, but it is nevertheless interesting to bear in mind that, with careful design, experiments of a unique and fundamental nature could be carried out in interplanetary space with present-day conventional propellents. It is, of course, likely that such research vehicles will arise from the RAND studies, for once even the primary orbital vehicle is established, the step beyond that to a guided-missile capable of liberating itself completely from the earth is comparatively small.

To obtain these deeper penetrations into space will require not only multiple-step rockets, but even more drastic techniques (such as expendable construction of the individual steps) where the projection of heavier payloads are involved. In a paper recently presented to the British Interplanetary Society by Messrs. A. M. Kunesch, A. E. Dixon and the present writer, a method of construction was outlined in which the forward portion of the rocket is broken down into separate tank stages which jettison progressively as propellent is consumed. Each stage consists of two half-cylindrical tank bays with integral structure, held together with explosive ties, which, on assembly, form an efficient hull. The tanks are pressure-balanced, permitting the use of light diaphragms for the backing panels.

To afford some streamlining effect in the early part of the ascent and to provide a light method of jointing, since all the tanks are faced together axially, the separate stages have conical noses. End loads would mainly be transmitted through external jointed longerons to which the tank bays are directly anchored.

In order to obtain a practical evaluation of the expendable-tank idea, a design study was made of a satellite rocket intended to reach its orbit between the altitudes of 600 and 700 miles. The rocket envisaged (Figs. 26 and 27 and Table III) is a three-step vehicle with the component rockets situated one within the other. In no case does the design exceed the limitations imposed by current engineering practice, and the propellent is taken conventionally as liquid oxygen and alcohol. The conservative nature of this study is

emphasized for it seeks to show that, if ever we are allowed officially to think "big" in terms of rockets here in Britain, we could effectively design orbital vehicles with a propulsion unit of no greater efficiency than the existing A-4 motor.

The specific impulse was taken as 204 at sea level, increasing to 240 as the rocket leaves the denser atmosphere; this is the figure already obtained in A-4 and Viking. A similar ruling was followed in selecting the structural factor. The motors are based on the A-4 propulsion unit, using the same thrust/motor weight ratio; also the same tank bay ratio as A-4 was used, including all structure, tanks and insulation. Finally, in this preliminary analysis, the payload weight was required to give fair scope for useful instrumentation without taking the initial mass to excessive limits. To obtain a reasonably accurate compromise, it was necessary to produce rough approximations for several possible projects, and from these a three-step expendable-tank rocket, with a 110 lb payload, was selected.

The ratio $\frac{\text{initial mass}}{\text{payload mass}}$ was taken as 14 (that of the A-4 is 13.3 and of the Viking, depending on the payload, 5.7 to 95.1). Therefore, on the basis of a 110 lb payload the final step has a mass of 1,540 lb, the second step 21,610 lb, and the first step, 302,000 lb. The thrusts of the second and final steps were fixed at 46,515 lb and 3,300 lb respectively, the acceleration varying between 1g and 8.6g effective.

TABLE III: CLOSE-ORBIT EARTH SATELLITE VEHICLE—CHARACTERISTICS

Vehicle	Overall Project (including 180 boost rockets)		1st Step		2nd Step		3rd Step	
	Met.	Eng.	Met.	Eng.	Met.	Eng.	Met.	Eng.
Gross Weight ...	161,545	356,125	137,000	302,020	9,800	21,610	700	1,540
Weight of Step	24,545	54,110	127,200	280,410	9,100	2,010	650	1,430
Structure wt. ...	14,303	31,520	22,290	49,140	1,927	4,250	137.6	303
Propellent wt. (including pump fuels)	115,152	253,850	104,910	231,270	7,173	15,810	512.4	1,130
Payload	50	110	9,800	21,610	700	1,540	50	110
Thrust Values ...	427,400 (at take-off)	942,200	193,300 to 211,000	426,130 to 465,150	21,100	46,515	1,500	3,300
Exhaust Flow (per sec.)	2,026.7	4,470	879.2 502.4	1,940 1,110	87.92	194	6.28	13.85
Total Propellent (flow/sec.)	2,059.6	4,540	912.1 521.2	2,010 1,150	91.21	201	6.52	14.37
Estimated Length (metres or ft.)	18.0	59.1	18.0	59.1	9.35	30.7	5.75	18.9
Estimated Diameter (metres) or ft.)	4.6	15.1	4.6	15.1	1.85	6.1	0.75	2.5
No. of Expendable Tank Bays	—		3 (Plus 3 motor units)		1		—	
No. of Motors ...	—		7 (3 jettisoned)		1		1	
Structure Factor $\frac{\text{Structure wt.}}{\text{Structure wt + Fuel wt.}}$	—		0.175		0.212		0.212	
Actual Mass Ratio (Mo/Mt) ...	—		4.2		3.73		3.73	
Effective Mass Ratio	84		5.31		4.25		3.73	
Specific Impulse	—		204 to 240		240		240	
S.I. Inc. Pump Fuels	—		197 to 232		232		232	
Firing Time (secs.)	283		125		79		79	
Characteristic V (km. or ft./sec.) (neglecting "g" and drag)	(Boost Motors) (207 680) 10,297 33,790		3.800	12,470	3.290	10,800	3.000	9,840

Note.—Weights given in kg and lb; Dimensions in metres and feet.

The initial step would be restricted to moderate thrust because of the limitations imposed by the A-4 propulsion unit. It was therefore decided to use seven unmodified A-4 units mounted on a thrust ring, each with its own pumps and ancillaries, four retaining their internal control vanes which would be aligned to act together.

To reduce the very large stresses that would otherwise occur in the second step if subjected to high accelerations with full tanks, the motors are so arranged that three complete units can be jettisoned. The acceleration of Step 1 is thereby held below 5g effective. It was assumed that solid-fuel booster rockets with semi-restricted burning (each developing 5,000 lb thrust for 5 secs) would assist at take-off.

The solid rockets are mounted in two banks around the base of the initial step, 92 in the first bank and 83 in the second, each bank of rockets being arranged two deep. It is necessary to eliminate the considerable impact thrust at take-off that would otherwise occur if the boost rockets were fired together to have the firing staggered over approximately 1½ secs for each bank.

It was assumed that launching would take place from an elevation of 13,000ft to reduce the effect of air resistance and to obtain optimum thrust over the sea-level value. Air resistance was calculated according to $\frac{R^2\, id f(v)}{1.22}\, k$ where R^2=area in cm²; i=shape coefficient=1 for 2 calibre radius nose; d=air density kg/m³ at any height; k=calibre coefficient.

Values of i for this project were taken as 1 for the first 50 secs, increasing to 1.15 as the nose shape alters as tanks are jettisoned. The coefficient k was taken as 0.5, and the values for $f(v)$ were obtained from the Krupp standard tables.

The boost rockets impart a velocity of 460ft/sec to the vehicle during their overall firing time of 13 secs. The first tank bay of Step 1 is jettisoned after 50 secs from take-off at a height of 56,000ft when the velocity has risen to 1,500ft/sec.

The synergy curve (taking the rocket from the vertical path into the orbit) is begun after 65 sec; the altitude is then 82,000ft and the velocity 2,160ft/sec. Jettisoning of the second expendable-tank bay occurs at 82 sec, when the rocket has reached a height of 124,700ft and a velocity of 3,200ft/sec. Finally, in this first stage, the third tank bay and three complete propulsion units are dropped; the time from take-off is then 102 sec, the altitude 197,000ft, and the velocity 5,700ft/sec.

Propellent in the remaining tank bay in Step 1 is utilized up to 125 sec. The vehicle will by this time have reached 325,000ft and be moving at 8,500ft/sec, before separation and firing of the second step.

The velocity has increased to 12,500ft/sec, when the single expendable tank stage of Step 2 is dropped at 138 miles; this stage completes its firing 204 sec after take-off at a velocity of 17,400ft/sec. The altitude is 186 miles and the total distance covered along the path of the trajectory, 250 miles.

The second step does not jettison immediately but remains attached to the third travelling under momentum. This is to ensure that the final step will be in correct alignment when its motor begins firing, it being arranged that the steam generator of the second step pump unit continues to produce steam for use in steering jets. The final step separates 75 sec before the peak of the trajectory, which lies between 650 and 680 miles.

The total velocity increment of the final step is 9,840ft/sec, and there will be negligible "g" loss in this stage of the trajectory when the vehicle is moving almost tangential to the earth's surface and approaching orbital height.

It is of interest to note that reduction of the desired orbital path to 500 miles permits the payload to be increased to 144 lb, or by retaining the original payload, a substantial reduction could be made in the initial take-off mass. The vehicle would be ground-monitored, the principal control equipment and instrumentation being contained in the second and final step.

The foregoing is not, of course, suggested as a serious design project, for had the task to be tackled on an official level, one would be at liberty to draw upon certain improved parameters. As it is, however, this simple analysis does show a useful order of magnitude in this kind of development. It

Evolution of the Guided Missile . . .

also serves to confirm certain definite advantages in expendable construction.

In the conventional rocket, such as the A-4, but more particularly with the simple step-rocket of which the A-4 WAC Corporal is an early example, the payload is carried in the nose. Therefore, the tank structure beneath must support, in addition to its own weight plus that of propellent, the loads induced by the payload, which, of course, increase as acceleration increases. In the case of the expendable rocket, however, the payload is supported directly by the motor thrust mounting, and the tank structure supports merely its own weight plus propellent; this naturally has important bearing on the structural factor. In addition, the tanks and supporting structure, which are integral, are jettisoned immediately they are emptied of propellent, and eliminate the need for accelerating unnecessary "dead weight" in the individual steps. In the case of the "satellite rocket" described, the use of expendable tanks in the first and second steps improved the respective mass ratios by 18½ and 14 per cent.

Probably the main disadvantages of expendable construction are that the odd-shaped tanks introduce special design problems and increased complexity, while in larger rockets there may be difficulty in the transfer of propellent at a high rate from one tank to another, and in sealing the transfer ports effectively as the tanks are jettisoned. These problems, however, do not appear to be insuperable and must be reckoned as part of the price we must pay in developing large high-performance rockets.

The military protagonists have heralded the satellite rocket as a potential atomic-bombing platform. As a long-term project, this may be perfectly reasonable. An atomic carrier set up in a permanent orbit which enables it to circle indefinitely over one point on the globe, if necessary to be retarded and guided back through the atmosphere by radio command, could be a powerful weapon.

Whatever may be the merits of the satellite rocket as a weapon, its implications in many branches of pure and applied science are considerable. An obvious commercial application is as a relay station for television to receive a transmission beamed to it and diffuse the programme back over nearly an entire hemisphere of the earth. In practice, three such stations situated 120 degrees apart would serve the entire planet (Fig. 28). (This development would be applicable to any short-wave radio transmission and would also have military uses in connection with the guidance of long-range missiles.)

The space-station offers unique possibilities as a "hard" vacuum research laboratory, especially suited to the study of electronics, and as a chemical research laboratory for testing the behaviour of common chemical reactions in a vacuum in the absence of effective gravity. Its use as a biological laboratory for the observation of cell growth and division both in the presence of corpuscular and electromagnetic radiations

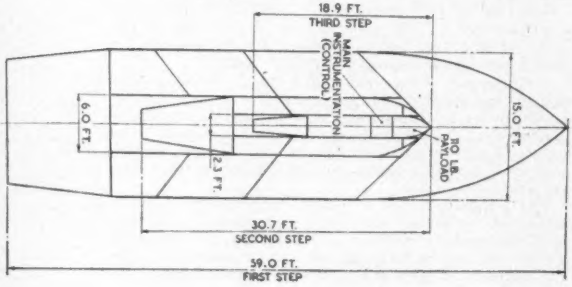


Fig. 27. The "close-orbit earth satellite vehicle"—basic configuration.

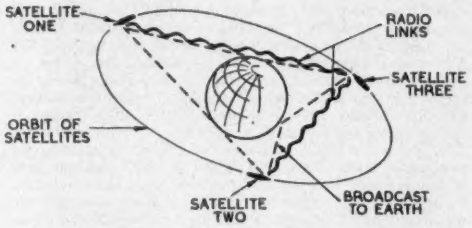


Fig. 28. Diagram showing the application of satellite rockets as relay stations for television. Situated 120 degrees apart on a 24-hour period orbit, three such relays would serve the entire planet.

and without the benefit of gravity, will open up entirely new fields for scientific study.

The benefits to astronomy and astrophysics that are likely to arise as space-flight develops are inestimable. The atmosphere has always been an impediment to the astronomer, blocking all rays beyond the ultra-violet and even in the visible spectrum, the light that reaches us is so distorted that the images of the stars and planets dance and tremble in the field of the telescope. New knowledge of the character of the universe may result from studies of primary radiations outside the atmosphere.

BIBLIOGRAPHY

J. V. Forrestal. *First Annual Report to Congress on the National Military Establishment*" December, 1948.

F. J. Malina and M. Summerfield. *The Problem of Escape from the Earth by Rocket, Journal of the Aeronautical Sciences*, August, 1947.

*"**K. W. Gatland, A. E. Dixon** and **A. M. Kunesch.** *Initial Objectives in Astronautics, Journal of the British Interplanetary Society*, July, 1950.

*Reprints of the paper read to the British Interplanetary Society in London on January 7th, 1950, can be obtained from the Secretary, 157, Friary Road, London, S.E.15, price 3s. 6d. post free.

PRODUCTION IN CANADA

THE Canadian House of Commons was told recently by Mr. Howe, Minister of Production, that the Government was concentrating heavily on aircraft production and that his department has placed orders for more than $400,000,000 of new aircraft.

He said that quantity production of the F-86 Sabre was limited only by the supply of engines and accessories from the United States. Harvard trainers, now being built at Fort William, were being completely constructed in Canada for the first time. Mr. Howe anticipated that Canada might even supply these American aircraft to the United States and Commonwealth countries.

The Canadian de Havilland Beaver had been selected for use by the U.S.A.F. and orders for 109 of them had been placed. A further and larger order was expected.

Canada, said Mr. Howe, would participate in the production of the Beechcraft T-36A twin-engined trainer, and plans were also under way to produce the Lockheed T-33 jet trainer.

Another report from Montreal states that an additional 3,000 to 4,000 workers will be needed by Canadair, Ltd., if and when plans to produce some 500 T-33s are completed. Currently, nearly 6,000 Canadair workers are now producing F-86s for the R.C.A.F., and the new project would raise the working force of the Cartierville plant to about 9,000 within the next year.

BOOKS RECEIVED

A Dictionary of Science, by E. B. Uvarov and D. R. Chapman. Penguin Books, Ltd., Harmondsworth, Middx. Price 2s.

"The Engineer" Directory and Buyers' Guide, 1951. *The Engineer*, 28, Essex Street, Strand, London, W.C.2. Price 2s 6d.

Diesel Model Engines, by Lt.-Col. C. E. Bowden. Percival Marshall and Co., Ltd., 23 Great Queen Street, London, W.C.2. 9s 6d.

The Rockets (Operation Manhattan), by Harry Edmonds. (Fiction.) MacDonald and Co. (Publishers), Ltd., 16 Maddox Street, London, W.1. Price 9s 6d.

Performance of a Piston-Type Aero-Engine, by A. W. Morley. Sir Isaac Pitman and Sons, Ltd., Pitman House, Parker Street, Kingsway, London, W.C.2. Price 25s.

The Wonder Book of the R.A.F. Ward Lock and Co., Ltd., 6, Chancery Lane, London, W.C.2. Price 12s 6d.

North of the Circle, by Frank Illingworth. William Hodge and Co., Ltd., 86, Hatton Garden, London, E.C.1. Price 15s.

Recognition test: the admirably arranged and well-stocked park of pioneer aircraft, seen from the Bristol Sycamore helicopter.

Illustrated with "Flight" photographs

FIFTY YEARS AT HENDON

AVIATION HISTORY ON VIEW FOR EVERYBODY:

"STATIC" IMPRESSIONS ON THE OPENING DAY

FOR the inauguration of the *Daily Express* Fifty Years of Flying Exhibition and Display at Hendon on July 19th, in commemoration of the jubilee of the Royal Aero Club, the weather was everything that the most enthusiastic visitor could desire. The sun was brilliant, and its heat nicely tempered by a ruffling breeze. Amidst the colour and the excitement, and in the presence of so many of the early pioneers who knew this airfield in its novitiate days, the display was opened by the arrival of the Lord Mayor of London, Sir Denys Lowson, who made a tour of the field with the first Marshal of the Royal Air Force, Lord Trenchard.

At six o'clock—when the Royal Aero Club became exactly 50 years old—a magnificent birthday cake was delivered to Colonel R. L. Preston by helicopter. What the cake weighed we have no idea, but it measured about 3ft by 2ft by 6in, and was slung by gilded chains from the Westland-Sikorsky S-51.

There was, of course, an enormous amount to see—far more than anyone could take in all at once: indeed, it is doubtful if, even if one spent the whole of each of the three days devoted to the event, a full appreciation of everything on view could be achieved. There was a free balloon; there was a captured V-2; there was a display of the development of rocket projectiles; there were historical and modern exhibits from Farnborough; there was the Cody Collection of historical material used by the great pioneer; there was a competitive display of models. There were R.A.F. police dogs, showing off their skill; there was an L.A.A. gun detachment of the R.A.F. Regiment doing the same thing in somewhat different fashion. The Royal Navy had its own section of the display with aircraft and models of ships and equipment; and the Army exhibited many items of the latest airborne equipment—parachutes, packed and unpacked—a Horsa glider and an Auster 6 A.O.P. The R.A.F., of course, had their place, and apart from the actual Service aircraft on the field, exhibited some of the latest power units, both of piston and gas-turbine type. But bulking by far the largest was the static park of aircraft, all arranged in serried ranks, brightly polished in brave display. The order in which the exhibits were ranged was basically chronological, the main park starting with the 1924 Hawker Cygnet, as the true pioneer types ranging from the Bleriot XI to the Avro 504K were accorded a separate little park of their own.

The Blériot XI (1909), Déperdussin (1911), Blackburn (1912), Sopwith Pup (1916), and Bristol F2B Fighter (1917), were all from the Shuttleworth Collection, and are comparatively well-known to those who have attended many post-war flying meetings. But the Blériot XXVII (1911), Caudron G3 (1912), Maurice Farman (1913), Bleriot XI Bis (1913), Sopwith Camel (1917), S.E.5A (1917), and Avro 504K (1918), were from the Nash Collection, and are less well-known, whilst the Sopwith Triplane (1916) included in the line-up, was loaned by the Science Museum and is the sole example. With the exception of the Caudron and the Maurice Farman, all of these ancient aircraft were in truly magnificent condition and looked, in fact, as though they might have been delivered to Hendon direct from the production line.

Close to the veteran aircraft stood the pioneer rotary-wing types, many—in terms of date—youngsters by comparison with the orthodox types, yet, by the very nature of their design, looking weird and almost prehistoric. The Cierva C.24 autogiro (1931), with its two tandem seats in a very narrow cabin beneath a rotor pylon structure somewhat reminiscent of the conning tower of a submarine, stood in a

The Lord Mayor of London, Sir Denys Lowson, seen arriving, was one of the most interested visitors on July 19th. Mr. Claude Grahame-White, the great pilot and organizer of the early Hendon days (seen with Mrs. Grahame-White), must have had a richer store of memories than anyone present. On the right is Sir Francis McClean, another illustrious pioneer.

FIFTY YEARS AT HENDON . . .

tail-down attitude owing to the fact that its D. H. Gipsy III engine was absent. Next to it was the Weir W.2 single-seat light autogiro of 1934. The twin-cylinder horizontally-opposed 45 h.p. Weir engine of this neat little aircraft is unusual in its use of individual induction systems with integral carburetters.

Both of these aircraft—which had been lent by the Science Museum—looked comparatively modern by contrast to the quite fantastic appearance of the Hafner R.2 which, nevertheless, was built only in 1931. The Hafner, of course, was a helicopter as distinct from an autogiro, and although the placard before the machine stated that it was fitted with an 84 h.p. Pobjoy "Niagan" (*sic*) III engine, examination of the unit revealed that it was, in fact, a Salmson nine-cylinder radial. This aircraft also exhibited a somewhat extraordinary method of torque reaction in its use of a pair of sycamore seed-like "wings" extending rearward on each side of the "fuselage" with their chords in a substantially vertical plane. The leading edges of these "wings" were uppermost, and each surface had a pronounced camber, the concave side being to port. A simple system of cables and pulleys enabled the angle of attack of these surfaces in the rotor downwash to be changed by movement of the "rudder" pedals. Torque reaction was evidently achieved by variation of lift from each of these surfaces.

Separated from the Hafner by the considerably more familiar Sikorsky R.4 was the Focke-Achgelis FA 330 man-lifting observation kite. This device employs a free-turning rotor, and was designed for towing behind surfaced U-boats. Looking surprisingly modern even in proximity to the svelte Bristol 171 Sycamore and the Westland-Sikorsky S-51, was the Cierva C-30A (1935). This aircraft is owned by a Mr. G. S. Baker of Ludlow, Salop, who uses it not only for pleasure but—we understood from Mr. Norman Hill, who was flying it in the display—for business journeys as well.

The baker's van—the Westland-Sikorsky S-51—delivers the birthday cake which, we believe, was by no means as "heavy" as the derrick would suggest.

To give even a brief description of every aircraft on view would need a very great deal of space indeed and, therefore, we propose to refer only to those aircraft whose present rarity or unusual design features commanded attention. The extremely neat little Hawker Cygnet two-seat ultra-light biplane of 1924 is the only specimen extant, and has been lovingly reconstructed by its owners, the original builders.

Of particular interest in view of the present design collaboration between Professor Hill and Blackburn and General Aircraft, the Westland-Hill Pterodactyl (1926) presented even in these days of several tail-less types, an incongruous appearance between the Cygnet and the Cirrus Hermes Moth which flanked it.

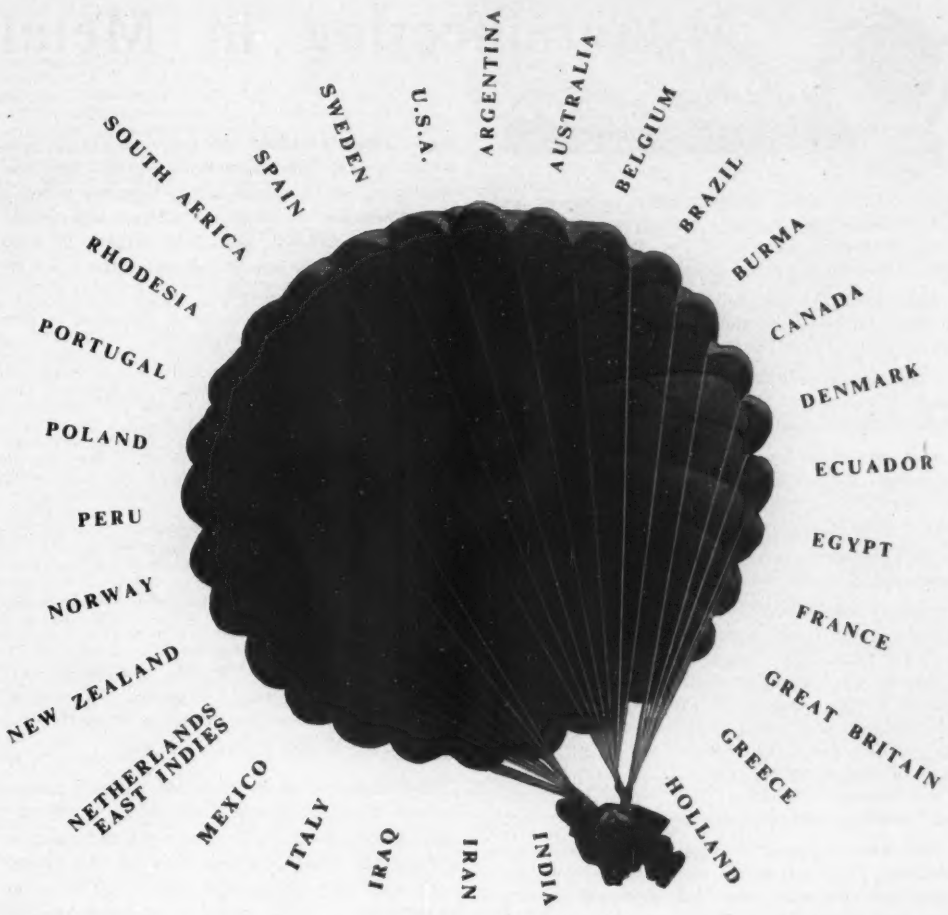
The 1928 Hawker Tom-Tit, which is so often seen at flying meetings in the hands of Neville Duke, glittered in the sun in its blazon of Sopwith blue and gold, whilst two places away from it stood the Warren-girder-strutted Parnall Elf (1929). Then there was the delightful little Heath Parasol single-seat ultra-light which, although built in 1929, exhibited the essential austerity of design and construction which was so widely featured by the immediate post-war ultra-lights shown at the 1946 Paris Salon.

The Spartan Arrow (1931) employs an aileron control linkage which could scarcely be simpler, in employing cables, bell-cranks and push/pull rods, all exposed below the lower wing; next to it—surely one of the most unusual aircraft ever designed, both in appearance and performance—stood the 1929 Handley Page Gugnunc. This unique little biplane was built for the Guggenheim Safety Competition in America, and established for all time the safety qualities of slots and flaps.

Hawker's famous Hart, G-ABMR, which was entered by Princess Margaret (to be flown by G/C. Peter Townsend) in the King's Cup air race, had the same dignified and attractive colour scheme as Neville Duke's Tom-Tit, and was separated by a very smart Puss Moth of the same vintage (1930) from a three-seat cabin Desoutter 1 monoplane of the same year. A somewhat larger machine than the Puss Moth, the Desoutter is characteri ed by a straight-through wing, with something like what today we call a droop-snoot leading edge, and by an undercarriage structure faintly reminiscent of the Cierva Air Horse. Tony Cole's Comper Swift shone in its coat of glistening black, but was closely rivalled in smartness of appearance by the Redwing II (1931), unusual among light aircraft in its day in having side-by-side seating. This machine is the only one left in this country and has been entirely rebuilt by students of the College of Aeronautical and Automobile Engineers.

An exceedingly smart Tiger Moth of the London Aeroplane Club stood next to an Avro Avian 4M which, although of the same date (1931), somehow looked curiously old-fashioned by comparison. Perhaps it is that the Tiger Moth has become so familiar, whereas one nowadays so rarely sees an Avian. With its metal fuselage unadorned by paint, and thus sharply contrasting with the cream dope of its wings and tail surfaces, the Blackburn B2 stood neatly at the end of its line, an extremely workmanlike and still very attractive little aircraft.

Although the placard for the Hawk Major (1934) quite accurately stated that the aircraft was a two-seat light



The world depends on

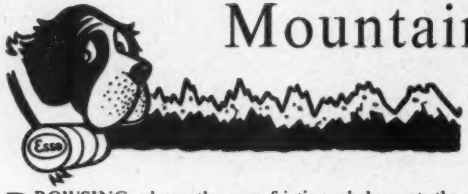
IRVIN

★ Throughout the world of aviation the name IRVIN is synonymous with safe descent, and the manufacturers of IRVIN AIRCHUTES have supplied parachutes of all types and for every purpose to the Governments, Naval, Military and Air Forces and Air Lines of the countries named above.

THE IRVING AIR CHUTE OF GREAT BRITAIN LIMITED · LETCHWORTH, HERTS, ENGLAND

Telephone: Letchworth 888 Telegraphic Address: Irvin, Letchworth

Mountaineering in Metal



BROWSING along the non-friction shelves at the library the other day my eye caught the title *A Plain Man's Guide to Lubrication.* I took the volume into a quiet corner and turned the pages. . . .

There was a photograph of either the Andes or the Rockies. Or was it the Alps? The high sierra, jagged peaks. I looked closer and read the legend—

" Steel surface ground with grade 150 carborundum. Height of irregularities about 3,000 to 10,000 Ångströms. Vertical magnification × 10,000."

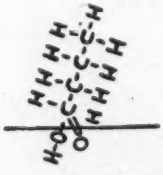
Well, you could have knocked me down with the proverbial. " An Ångström? " said the young lady at the counter. " An Ångström is one ten-thousandth of a micron or one hundred-millionth of a centimetre—why?"

" Oh, nothing," I said. " Silly of me to forget." I returned to my corner and read on.

Metal surfaces that appear perfectly smooth to the naked eye, the author revealed, are in reality extraordinarily rough. They are pitted and scored by deep valleys and traversed by chains of mountains with lofty peaks known as " asperities." Thus when two surfaces rub together a fair amount of friction is generated and the metal surfaces suffer wear and tear. (The experts speak of " plastic deformation," " elastic deformation," " local welding," " abrasion " and " molecular attraction," but they *mean* wear and tear—I think.)

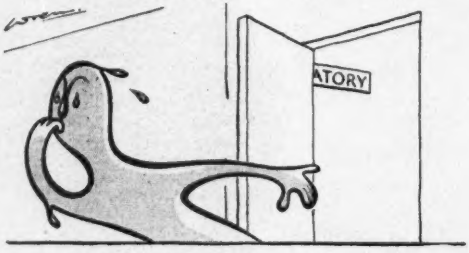
Now wear and tear, it seems, can be reduced by lubrication (" No, not for me, thanks, I'm driving"), by splash feed lubrication, force feed lubrication and full force feed lubrication—to blazes with technicalities: let's call it hydrodynamic or fluid film lubrication—all are achieved by using the best lubricants. Esso lubricants.

This little diagram will, perhaps, make everything crystal clear:



It does? Good.

Let's go back a bit. The engine used by the Wright brothers differed very little from the ordinary motor car engine of the day, and the motor oil of the day was good enough to keep their biplane flying without a fatal dose of friction. But as aircraft engines improved in power and performance, as speeds and pressures and cylinder temperatures rocketed, lubrication outgrew its early infancy and entered the laboratories. Here it can be seen entering the laboratories:



Aircraft became larger, heavier, flew higher . . . 10,000 feet . . . 20,000 feet . . . 40,000 feet . . . and lubricants were required to flow readily at 0 deg. F. . . . –33 deg. . . . –67 deg. Esso supplied them.

Esso still supplies them. In the labs. scientists concoct complex chemical compounds known as " additives," substances which are (yes!) added to oils and greases to increase their efficiency. Some years ago they devised additive 'A' (let's call it) which prevents oil congealing in cold weather; then there was ' B ' which helps oil carry the heavier loads imposed by increasingly powerful engines. 'C' prevents excessive thinning-out when hot, excessive thickening when cold. And then there are ' X ' and ' Y ' and ' Z.' And ' E ' and ' S ' and ' S ' and 'O'. Yes—

It pays to say

Esso

FOR ALL PETROLEUM PRODUCTS

ESSO PETROLEUM COMPANY, LIMITED, 36 QUEEN ANNE'S GATE, LONDON

FIFTY YEARS AT HENDON . . .

monoplane, in point of fact the example shown (G-ADMW, belonging to A. E. H. Coltman) had the front cockpit very neatly faired over for racing advantage. Next to it stood one of the most famous aircraft in the park, the Percival Gull Six, *Jean*, proudly displaying on the side of the cabin a list of the records established by Miss Jean Batten in 1935/36/37.

The Hawk Speed Six now owned by Throttle-bender Ron Paine, and made famous by him and other pilots, bore its racing number "96," and was chiefly remarkable both for the highly-polished skin panelling, and for the beautifully-formed bubble canopy enclosing its single-seat cockpit.

"*Fricker's Fliegerwagon*," in other words, the B.A.C. Super Drone owned by John Fricker, had the fabric of its port wing and aileron gashed in a manner which made it look distinctly the worse for wear, whilst next to it stood the only Australian aircraft at the display, the Wicko G.M.I. (1936) owned by Miss Lettice Curtis. The comparatively clean lines and quite orthodox appearance of the Wicko, and even more, the patently thoroughbred lines of the Miles Whitney Straight, contrasted almost laughably with the little Flying Flea which stood between them. The Flea, in common with others of the more esoteric aircraft on view, is owned by the Science Museum.

Beyond the Whitney Straight stood the starkly utilitarian Dart Kitten which, despite the evident cheapness of its construction is, nevertheless, a not unattractive little machine. Only two are now left.

Surely one of the most ungainly of (relatively) modern light monoplanes, the snub-nosed Aeronca C.3 offered sharp contrast to the Hawk Trainer 3, better known, perhaps, to thousands of Servicemen as the Magister. A good-looking aircraft, the Percival Q.6, sometimes called the Petrel, was loaned by the Yorkshire Aeroplane Club; not unlike an enlarged twin-engined version of the Vega Gull, its modern appearance belies its 14 years.

Of the same age (1938) but of widely differing appearance, the General Aircraft Cygnet, one of the first British light aircraft to be fitted with a tricycle undercarriage, was in close company with the famous Percival Mew Gull which, now owned by Hugh Scrope,(who discovered it in France last year), was the winner of the King's Cup race in 1938. Flown by Alex Henshaw, it averaged 236 m.p.h.—the highest speed at which the race has been won.

Adjoining these aircraft of the heydays of private flying, stood some of those machines, the names of which will go down in history under the fateful period, 1939-45. Swordfish, Hurricane (*The Last of the Many*, but once more in camouflage—this time for a film), Oxford, Spitfire, Wellington (a Mk 10 crew trainer), Fulmar, Mosquito 3 and Tempest, these were complemented by the later Proctor 4, Meteor 4, Anson 19—albeit developed from the original 1935 design—and an Auster 7.

Among the post-war aircraft were an Aerovan (with Lycoming engines), Mercury, Messenger, Autocrat, Gemini (*Flight*'s), Dove, Consul, Anson 19 (civil version), Chipmunk, Proctor 5, Sealand, an Autocar, and the first aircraft to be produced by F. G. Miles since the formation of his new company—the Aries. This is a development of the Gemini, but has a slightly longer fuselage, and more powerful (150 h.p. Cirrus Major) engines. It made its first flight three months ago, and was the newest aircraft exhibited at the show. The Short Sealand amphibian, which was seen to have sprouted four wing "fences," was the sole example of a marine aircraft, and no finer representative of its class could have been found.

And so there it was, a great, even magnificent, concourse of aircraft, all laid out in orderly array so that one could see the progressive march of light aircraft design philosophy, could see in rightful perspective those types which stood out above their contemporaries as being "ahead of their time." Looking back, one is conscious chiefly of the extraordinarily good condition of even the more elderly of the assembled machines. Many have been airborne for the last time and are content now to rest in the cherishing care of some enthusiast; many are still giving their owners a breath of fresh air and escape from earthly cares. But all were spruce and proud in their place, and it was heartwarming to see them again.

The 28 h.p. three-cylinder Anzani in the 1911 Déperdussin monoplane is tucked behind the leading edge of the shoulder wing and, as our photograph shows, is braced from the cabane.

A stable of old warhorses: from right to left, the Sopwith Pup, Sopwith Triplane, Sopwith Camel, S.E.5A and Avro 504K. The Pup and Camel had their guns mounted.

An A-4 (V.2) war rocket, captured in 1945, was displayed on the "meiller-wagon" with the aid of which it was positioned for launching. In the background are spruce-looking aircraft of the Royal Navy.

CIVIL AVIATION

THE COMET'S JOHANNESBURG FLIGHT

REPRODUCED below are some extracts from a letter which we have received from Mr. Martin Sharp of the de Havilland Company, who was a passenger in the Comet on its recent flight to Johannesburg, via Cairo and Entebbe. The total distance of the outward journey was 6,212 statute miles, and the overall time, chocks, Heathrow, to chocks, Johannesburg, was 17 hours 33 minutes, giving a speed, including halts, of 354 m.p.h. Times and speeds for each leg are tabulated. At Cairo, the Comet took on 4,900 gallons of kerosene and its take-off weight was 104,060 lb, while at Entebbe 4,000 gallons were supplied, and the take-off weight was 98,502 lb.

In view of the considerable period which frequently elapses between starting up and taking off, and between landing and cutting engines, the following times for the Comet in the order chocks away to take-off, and touch-down to chocks, at Heath Row, Cairo, Entebbe, and Johannesburg respectively, are well worth recording: 1830—1837; 2345—2348; 2445—2451; 0559—0602; 0729—0735; 1201—1203.

Comet (London-Johannesburg) Flight—July 17th to 18th, 1951

	London Airport-Cairo	Cairo-Entebbe	Entebbe-Johannesburg
Distances (miles)	2,280	2,082	1,850
Airborne times (Take-off to touch-down hr min)	5 8	5 8	4 26
Chock times (hr min) ...	5 18	5 17	4 34
Airborne speeds (m.p.h.)	442	405	418
Ground times at chocks	57 min (Cairo)	1 hr 27 min (Entebbe)	——

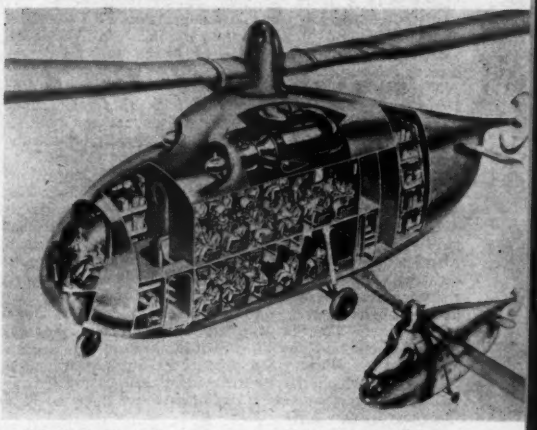
Mr. Sharp writes: "This flight has demonstrated that the London-Johannesburg route can be worked economically and well with the Series 1 Comet. Entebbe runway has been a pleasant surprise. Its contour includes a stretch of downgrade which is worth some thousands of pounds of take-off weight to a jet aircraft. The result is that Comets can do the outbound trip regularly with full payload (B.O.A.C.'s 36-passenger version with 12,500 lb), with only the two halts at Cairo and Entebbe, in under 20 hours as a regular thing. We did it comfortably in 17 hr 33 min. Homeward, the Comet will probably have to call also at Livingstone and Rome, because Johannesburg is too hot and high for a full payload take-off to Entebbe, and Cairo is too hot for a full payload to London at all seasons because of westerly winds. In practice B.O.A.C. will probably work the Johannesburg line with four halts *both* ways—Rome, Cairo, Entebbe, Livingstone—so as to give a balanced public service.

"What really *does* tell is that 5 hours (2,000 and more miles) in a Comet doesn't tire the passengers or crew, and a continuous 6,000-mile journey like the one we have done doesn't either. It is the absence of vibration. You feel unstressed, somehow. This Comet (OZ) has a 28-seat compartment furnished and is quieter than a Connie. We plan to return home via Livingstone, Entebbe, Khartoum, Cairo, Rome. To-morrow we shall be trying out at Pietersburg."

SORTING OUT THE SUBSIDY

THE C.A.B. is now planning to introduce an arrangement by which airmail pay can be satisfactorily separated from Government subsidies to airlines. In a recent letter to the chairman of the Senate Commerce Committee, Mr. Donald Nyrop, chairman of C.A.B., disclosed that new agreements on airmail pay have been reached with the four largest U.S. operators, A.A., E.A.L., T.W.A. and U.A.L. with whom discussions along these lines have been in progress for more than a year.

As a result of these conferences, the four carriers have agreed to accept a mail rate of 63 cents (about 4s 6d) per ton-mile for the period from the beginning of the proceedings until December 31st, 1950, and a compensatory rate of 45 cents (about 3s 4d) per ton-mile from January 1st, 1951. On the same issue, the Senate's Small Business Committee has called for a new government policy towards non-scheduled airlines: it has requested that the C.A.B. should cancel its order restricting the number of flights made by these smaller operators. The committee is of the opinion that the present arrangement merely results in the use of a subsidy



TOMORROW'S HELICOPTER: This artist's conception of the Howard Hughes 205 twin-turbine-powered helicopter represents a stage in rotor-craft design which may be much nearer than we think. It would have a seating capacity for 70 passengers, a range of 200 miles and would cruise at over 100 m.p.h. A "skeleton" prototype began its trials last year. A revolving lift is installed aft, for baggage stowage.

to provide expensive luxury services for a small part of the population. It is thought that an immediate large-scale expansion of low-cost "coach" travel is needed. Recent operations by non-scheduled companies are cited as proof of the large potential which exists for this type of travel.

Most of the largest American operators, incidentally, have this year enjoyed the best six-month earning period in their history. New traffic records were established almost continuously from the beginning of the year. June produced an all-time record for all major operators, with the exception of United who were seriously affected by their 11-day strike. An estimate of the total traffic puts the passenger-mileage figure at over 5,000 million, an increase of 45 per cent over the corresponding period of last year; air cargo rose by as much as 130 per cent.

The main result of this extensive traffic improvement is that, in spite of high taxes, there has been a sharp rise in net profits. Although at the moment American Airlines is the only large carrier subject to excess purchase tax, it is thought possible that other companies may become so liable this year. Mail rates, however, are being lowered slightly and costs are moving slowly upward. It is thought that a truce in Korea might reduce the movement of passengers to and from the west coast but that traffic during the remainder of the year will continue at a highly satisfactory level.

B.E.A.'s UPS AND DOWNS

ALTHOUGH having to combat more than its fair share of troubles in the form of crew and aircraft shortages, B.E.A. has this year enjoyed a very considerable increase in business. The Corporation carried its millionth passenger recently, an achievement which has only been equalled by six other airlines in the world, all of them American. Costs, however, have continued to rise this year, and in May amounted to almost £1,000,000. The deficit for May (£44,856) was actually £20,000 less than the corresponding period of the previous year, although the loss for April-May was slightly larger than in 1950. B.E.A.'s most urgent need, of course, is for larger-capacity aircraft, and the news last week that the Elizabethans have now been awarded a full C. of A. carries with it the promise that these aircraft may now be available rather sooner than recent forecasts have intimated. It is thought, in fact, that the first Elizabethan will be delivered into B.E.A.'s hands in about a fortnight's time.

Having struggled manfully against many difficulties this year, it is particularly unfortunate that just as traffic is approaching its summer peak a number of services have had to be cancelled because

of a "go-slow" strike by more than 500 ground-crew members employed at Northolt. Last Saturday 42 services had to be cancelled and on Sunday this figure had risen to 50. The strikers are members of the Association of Supervisory Staffs, Executives and Technicians who began working to rule after an offer of a wage increase less than that demanded by the Association. Thus B.E.A., it seems, is faced with another considerable financial set-back which it is not in a position to offset by offering additional capacity later on. To help meet the shortage of trained air-crews it is understood that the R.A.F. is to make available (thought to be eight) a number of radio operators on indefinite loan to B.E.A. They will wear the Corporation's uniform but will receive ordinary Service pay.

AER LINGUS PROFIT

AER LINGUS has announced a profit of £14,646 on its operations during the financial year ended March 31st. Gross revenue, at £1,300,000, showed an increase of about £160,000 over last year's figure. For the same period, however, expenditure increased by over £100,000, due to a rise in operating costs and an increase in capacity ton-mileage flown.

The company's operations, with a standardized fleet of DC-3s, have been conducted at a very good passenger load-factor of 69 per cent (the o.r.l.f. was 65 per cent) and this fact, together with the exercise of stringent economy on overheads has enabled Aer Lingus to hold its own against the general trend of rising costs in Europe. The Holy Year traffic, involving the carriage of over 3,000 pilgrims by special charter flights, also helped to swell traffic on the company's routes to Paris and Amsterdam.

Aer Rianta, which holds a 60 per cent interest in Aer Lingus and is responsible for the running of Dublin Airport, also showed a small operating profit of £3,884. Its general administration account (covering the company's activities other than the management of the airport) resulted in a deficit of £4,176.

AUXILIARY POWER FOR DC-3s

THE controversial problem of whether or not to extend the utility of the ageing DC-3 by re-powering it with a more suitable engine is one which has been in the minds of many operators during recent months. One difficulty is that in Europe, at least, even re-conditioned American engines of higher power are virtually unobtainable. Of special interest, therefore, is the French project (of which an example was shown at Le Bourget recently) to give auxiliary power to DC-3s by equipping them with a Turboméca Palas turbojet. By affixing this unit beneath the fuselage, the installation is achieved without the need for any major structural modifications, cheaply, and with a very slight increase in weight. The additional thrust available at take-off allows an augmentation of about 1,540 lb in payload and enables the gross weight to be increased to 29,000 lb. Equipped with the Palas, the DC-3 is claimed to satisfy I.C.A.O. requirements with regard to single-engine flying.

BRITISH AIRWAYS OPERATING STATISTICS FOR THE FINANCIAL YEAR 1950-51

(Figures for the corresponding year given in parentheses)

	B.O.A.C. All Areas	B.O.A.C. Western Area	B.O.A.C. Eastern Area	B.O.A.C. South American Area	B.E.A. All Divisions	B.E.A. Continental Division	B.E.A. British Division	B.E.A.'s Associates
Revenue a/c-miles ...	27,716,678	4,248,477	17,032,151	5,475,198	21,307,907	15,114,916	6,192,991	1,532,531
	(28,262,267)	(3,813,819)	(18,464,360)	(4,617,648)	(16,321,084)	(11,119,653)	(5,201,431)	(1,546,516)
Total a/c-miles	30,446,249	4,411,070	17,289,438	5,680,160	22,257,335	15,415,605	6,380,093	—
	(31,650,604)	(4,004,973)	(18,868,074)	(4,801,523)	(17,234,392)	(11,369,669)	(5,356,706)	—
Revenue passengers ...	196,256	45,910	106,757	43,589	939,607	495,888	443,719	60,977
	(154,076)	(36,318)	(95,163)	(22,595)	(751,512)	(344,375)	(407,137)	(65,230)
Revenue pass.-miles ...	568,724,061	140,276,028	360,265,632	68,182,401	266,496,521	189,315,176	77,181,345	9,581,535
	(420,800,423)	(87,599,809)	(302,620,979)	(30,579,635)	(213,810,100)	(144,033,576)	(69,776,524)	(8,453,436)
Available seat-miles ...	1,008,748,696	258,718,552	556,561,347	193,468,797	448,950,450	314,677,338	134,273,112	16,619,499
	(693,100,474)	(137,974,067)	(469,111,943)	(86,014,464)	(337,255,486)	(227,419,272)	(109,836,214)	(14,568,467)
Rev. load factor (pass.) ...	56.4	54.2	64.7	35.2	59.4	60.2	57.5	57.7
	(60.7)	(63.5)	(64.5)	(35.6)	(63.4)	(63.3)	(63.5)	(58.0)
Cargo (tons):								
Mail	2,026.7	379.4	1,420.7	226.6	4,685.6	3,206.7	1,478.9	8.9
	(1,788.5)	(406.7)	(1,218.3)	(163.5)	(3,722.3)	(2,440.9)	(1,281.4)	(3.9)
Freight	4,902.2	839.4	3,343.3	719.5	10,123.4	7,737.7	2,385.7	5,497.6
	(3,905.9)	(600.9)	(2,789.7)	(515.3)	(6,446.0)	(4,550.5)	(1,895.5)	(4,422.2)
Rev. load ton-miles ...	83,983,516	17,279,883	56,645,234	10,058,399	28,115,840	21,339,746	6,776,094	1,068,079
	(64,134,670)	(11,479,574)	(46,763,807)	(5,891,289)	(22,515,015)	(16,443,144)	(6,069,871)	(907,572)
Usable capacity ton-miles	144,069,708	30,015,131	84,505,128	26,028,311	48,883,001	36,418,960	12,464,041	2,126,637
	(121,828,560)	(19,940,962)	(77,568,053)	(18,131,281)	(37,085,496)	(26,887,819)	(10,197,677)	(1,769,018)
Overall rev. load-factor	59.8	57.6	67.0	38.6	57.7	58.7	54.8	50.2
	(55.5)	(57.6)	(60.3)	(32.5)	(61.4)	(61.6)	(60.8)	(51.3)
Total revenue hr ...	125,610	17,223	79,551	24,501	144,776	93,125	51,651	13,019
	(142,359)	(16,565)	(92,804)	(23,632)	(110,693)	(67 147)	(43,546)	(14,353)
Total non-revenue hr ...	14,608	839	1,348	1,002	7,143	1,996	1,768	—
	(20,128)	(970)	(2,279)	(1,009)	(6,915)	(1,652)	(1,447)	—
Equivalent annual utilization (rev hr per a/c) ...	1,661	—	—	—	1,533	1,825	1,197	—
	(1,426)	—	—	—	(1,279)	(1,468)	(1,078)	—
Unduplicated route-miles	72,175	8,074	44,371	19,730	17,033	14,101	2,932	2,025
	(70,854)	(7,713)	(46,113)	(17,028)	(11,885)	(9,498)	(2,387)	(2,355)
Percentage regularity ...	96.6	97.3	96.7	95.7	94.9	94.5	95.2	99.0
	(97.9)	(95.3)	(98.1)	(97.7)	(97.1)	(96.5)	(97.5)	(98.9)
Average stage flight (miles)...	1,085	1,401	1,094	904	220	356	119	100
	(1,031)	(1,127)	(1,051)	(902)	(208)	(359)	(114)	(96)

AS mentioned briefly in these pages last week, the M.C.A. has now published the provisional operating and traffic statistics of the United Kingdom Corporations for the financial year ended March, 1951. These show that, in all, the Corporations enjoyed approximately one-third more traffic than in the previous year. The actual totals achieved were 835 million passenger-miles (an increase of 32 per cent), and 24 and 13 million freight and mail ton-miles respectively, representing increases of 30 and 18 per cent. over the figures for 1949-50. The average passenger load-factor for both Corporations fell from 62 per cent in the previous year to 57 per cent last year. The overall revenue load factor, however, rose to 59 per cent as compared with 57 per cent in the previous year.

B.O.A.C. increased its total traffic by 31 per cent to 84 million revenue load ton-miles; the o.r.l.f. also rose by 4 per cent. The Corporation carried 196,000 passengers for a total of 569 million passenger-miles at a load-factor of 56 per cent. Traffic was seen to be highest on services in the Eastern Area, where it reached 57 million load ton-miles. In this area, also, the o.r.l.f. rose to 67 per cent as compared with 60 per cent in the previous period.

B.E.A.'s total traffic also improved considerably, reaching a total of 28 million revenue load ton-miles as compared with 22½ million in 1949-50. This traffic was carried, however, at a reduced load-factor of 58 per cent (as against 61 per cent last year). The totals achieved for passenger traffic were 948,000 passengers carried and 266 million passenger-miles flown. B.E.A.'s passenger load-factor was down by 4 per cent to 59 per cent.

In general, improvements were more marked on the Continental routes than on those within the United Kingdom, the respective increases in revenue load ton-miles flown being 30 and 12 per cent. Overall revenue load-factors in the British Division declined to 55 per cent from 61 per cent and to 59 per cent from 62 per cent in the Continental Division.

Charter firms operating under associate agreements with B.E.A. also enjoyed improved traffic. Passenger-miles flown rose by 13.3 per cent for a capacity increase of 14 per cent. The most spectacular improvement, however, was seen in the carriage of mail which increased by 128.2 per cent. The average o.r.l.f. for scheduled services flown under associate agreements was about 51 per cent, although the figure for the purely passenger-carrying flights stood at the more satisfactory level of 58 per cent.

Detailed traffic statistics for both Corporations and for the scheduled services flown under associate agreements with B.E.A. are given in the table above.

CIVIL AVIATION . . .

BREVITIES

THE Indian Government has cancelled all charter and non-scheduled flights by Indian airlines. This action is said to have become necessary in order to conserve petrol in view of the Persian oil situation.

* * *

Mr. H. H. "George" Harman, general manager of Qantas Empire Airways, retired from his post last month; he will be succeeded by Mr. C. O. Turner.

* * *

Three of Sabena's DC-4s which the Belgian Government sent to assist in the Pacific airlift have just completed their 100th return flight between San Francisco and Japan.

* * *

The Israeli airline, El Al, which operates a route linking Johannesburg and New York, *via* Lydda, has opened a company branch office in London, in conjunction with the firm of Shoham (Maritime Services) Ltd.

* * *

Having completed a year of duty on the Korean airlift, P.A.A. announce that their aircraft have carried, in all, 30,000 passengers and 11 million pounds of cargo on 968 round trips across the Pacific. At the height of the airlift some 24 aircraft were operating under Pan American's direction on this route.

* * *

Because of the heavy demand for bookings on its dollar-earning route between New York and Bermuda, B.O.A.C. has added a fourth round trip to its present schedule of three per week. The "Bermudian" service was re-established on June 1st, and traffic figures for the first month showed a load factor of 74.4 per cent.

* * *

The Australian Government has approved an expenditure of £27,000 for the provision of a passenger terminal for Norfolk Island. A new terminal is also to be erected at Port Lincoln airfield, in South Australia, and a further £30,000 will be spent on runway improvements at Port Moresby.

* * *

On behalf of Eastern Air Lines, Capt. Eddie Rickenbacker, the company's president, has signed a 100,000,000-dollar re-equipment order involving some 90 replacement aircraft. Thirty of them will be L-1049 Constellations (to cost 55 million dollars) while the remaining 60 will be the new Martin 4-0-4s. The company will retain the 20 L-749 Constellations which are now in service.

* * *

Trans-Australia Airlines have requested Government approval for the purchase of six Vickers Viscounts, for use on the company's internal routes. The cost of the aircraft is estimated at £1,520,000 and it has been stipulated that they will be bought only if a guarantee is given that supplies of paraffin will be available free of customs duty.

* * *

The first aircraft ever designed exclusively for agricultural work—a single-engined high-wing monoplane designated the AG-1—was demonstrated recently in America. It has exceptionally good low-speed characteristics and is able to land in approximately three times its own length. With its high-lift wing, full span flaps and robust undercarriage, it is particularly suitable for rough-field operation. Developed specifically for crop dusting duties to the requirements of American farmers, the AG-1 will be priced at about 8,000 dollars (approximately £2,850).

LEARNING THE ROPES: Taking a professional interest in the workings of Montreal Airport's control tower are two members of the fourth I.C.A.O. Trainee Programme, Mr. A. Paoletti, of Italy, and Mr. D. Abdul-Hak, of the Lebanon. On completing their studies they will return to their home countries to help maintain a close liaison between their own administrations and I.C.A.O.

The C.A.B. has authorized the operation of America's first helicopter taxi service. It will be run by Los Angeles Airways and will serve towns within 50 miles of that city. L.A.A., of course, have been running cargo and mail services in the area since 1947. The new scheme has been approved for a period of five years.

* * *

Mr. Dhan Mukerji, a son of the celebrated Indian author and philosopher, Mr. Dhan Gopal Mukerji, has been appointed traffic and sales manager to the Atlantic Division of P.A.A. He has been with Pan American since 1941 and in recent years was responsible for line offices along the company's Pacific routes.

* * *

B.O.A.C. have just completed the longest charter flight the Corporation has ever been called upon to make. It entailed a round trip of 25,000 miles from London to Melbourne to relieve a British ship's crew whose contracts had expired. A 40-seat York completed the journey in 15 days.

* * *

The M.C.A. has announced a number of new appointments in its Scottish Division. Mr. W. F. Rimmer has been appointed Scottish Divisional Operations Officer, in succession to G/C. G. F. K. Donaldson, who is now to command the M.C.A. Flying Unit at Stansted. Mr. Crawford Halley, D.S.O., has taken over the Scottish Eastern Group of civil airports from Cdr. G. A. Nunnery, O.B.E., R.N.(Retd.), who is now to be airport commandant at Castel Benito, North Africa. Mr. Edward Wright will shortly become commandant of the Northern Group of airports, in succession to Mr. J. H. de P. Rennick, who is taking up a post at the Ministry's headquarters in London.

THE NATIONAL GLIDING CONTEST

THIS year's British National Gliding Championships—now in progress at the Derbyshire and Lancashire Gliding Club's site at Great Hucknall—hold high promise of some exciting contests and are likely to see the establishment of several new records. A complete list of participants is given in the accompanying table.

Twelve different types of aircraft have been entered, the most common being the British Eon Olympia, which, it will be remembered, is only basically of German design. There is also one original German Olympia which is being flown by Lt. Cdr. H. C. N. Goodhart of the Royal Naval Gliding and Soaring Association.

Entries are in either Team or Individual classes. In the latter class there are seven competitors, all of them top-rank gliding pilots. They include Philip Wills, C.B.E. (chairman of the B.G.A., winner of four recent championships, holder of the Britannia Trophy for 1950 and also of two national records), Mr. Lorne Welch (now chief instructor at the Surrey Gliding Club, and a member of last year's international team), Mr. G. H. Stephenson (placed third in the 1950 championships, and the first glider pilot to cross the Channel); and F/L. A. W. Bedford, of the R.A.E., Farnborough, who now holds four national records.

There are two women entrants—Mrs. Ann Douglas (chairman of the Surrey Gliding Club), and Miss M. Gilbert, who also flew in the last year's contests. The Services are represented by 24 pilots, of whom 20 are serving with the R.A.F., two with the Navy and the remaining two with the Army. Two Sedbergh T.21 Bs have been entered by the A.T.C.; the team captains are S/L. J. C. Ward and F/L. Neubroch, and during the contest flights, the

MESSIER
UNDERCARRIAGES

Feather-weight Touchdown!

This Messier nosewheel undercarriage is designed to absorb energy on landing at the highest efficiency and, at the same time, allow adequate flexibility when taxying. Powerful steering gear is fitted and shimmy is eliminated by rigidly coupled wheels.

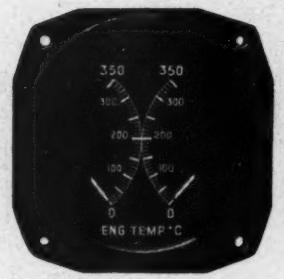
BRITISH MESSIER LTD · GLOUCESTER

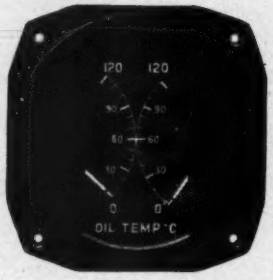
BS.1

No. 1 Temperature Measuring

The comprehensive range of Weston temperature measuring instruments covers the requirements of existing production aircraft, as well as types now under development. In addition to thermometry for the indication of cylinder, air, oil and radiator temperatures, Weston equipment for aircraft includes instruments for power supply, navigational aid instruments, selector switches, etc.

WESTON
AIRCRAFT INSTRUMENTS





Illustrations show:

Above, Model S128. Dual Engine Temperature Indicator, comprising two Millivoltmeters of 100° scale housed in large-size S.A.E. case. For use in conjunction with copper/constantan, iron/constantan or chrome/allumel thermocouples.

Below, Model S127. Dual Ratiometer Indicator, comprising two 100° Ratiometer movements housed in large-size S.A.E. case. For use in conjunction with thermometer bulbs, electrical oil pressure transmitters, electrical position indicators or any combination of two of these to indicate a variety of temperatures, pressures or position.

SANGAMO WESTON LIMITED
Enfield, Middlesex

Tel.: Enfield 3434 (6 lines) and 1242 (4 lines). Telegrams: Swanwest, Enfield.
Scottish Factory, Port Glasgow, Renfrewshire, Scotland.

Branches, Glasgow, Manchester, Newcastle-on-Tyne, Leeds, Liverpool, Wolverhampton, Nottingham, Bristol, Southampton, Brighton.

AEROSERVICES (LONDON) LIMITED

Announce that their

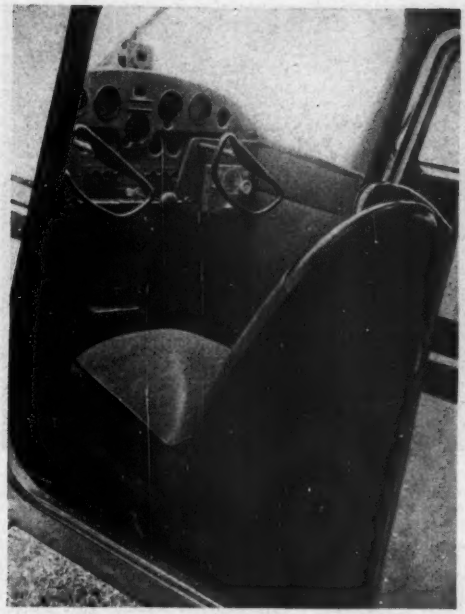
TWO DAKOTA AIRCRAFT HAVE BEEN SOLD

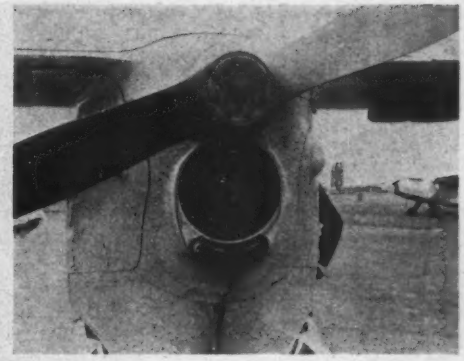
on the 25th June, 1951. They were sold by us to an American buyer

We shall have several other Dakotas for sale in September
Keep in touch with us if you want one

31, CLARGES STREET
LONDON W.1.

TELEPHONE: GROSVENOR 7378
CABLES: AEROPAUL LONDON





A CLOSER LOOK at some of the less common light aircraft which arrived at Gatwick last week (see page 110) revealed such interesting details as the turbine-like engine cooling fan installed immediately beneath the pusher propeller of the unorthodox French Courlis; the beautifully appointed cabin of the Cessna 170 also caught our eye.

CIVIL AVIATION . . .

machines will be carrying A.T.C. cadets in the passenger seats.

Cash prizes are being awarded to the entrants of gliders placed 1st, 2nd and 3rd in both the Team and Individual classes, while the club whose glider earns the greatest number of marks in the Team class will be awarded the essentially practical prize of 15 gallons of dope. A number of additional trophies and daily prizes are also being announced during the contests.

These, of course, are quite apart from the championship awards for the best performances recorded during the National Contests. The Kemsley Cup is given to the glider pilot whose machine earns the greatest number of marks for the team championship. The Londonderry Cup goes to the winner of the individual championship and the L. Du Garde Peach Trophy to the winner of the team championship. The Firth-Vickers Trophy is presented for the best performance by a British pilot in a British-designed and built sailplane. Finally, the Eon Cup—for competition among entrants of whichever type of British-built glider is numerically predominant—is awarded to the entrant of this type gaining the greatest number of marks.

This year the organizers are following a new course in designating a number of special tasks for each day's gliding. They consist of (1) a race to a goal predetermined by the organizers, (2) a race over a pre-set course, (3) an out-and-return flight in which the turning point is also determined beforehand, and (4) a distance flight to a goal specified by the pilot himself. Marks are awarded to the entrant of the glider for speed, distance and height achieved, and the entrant gaining the highest number of marks during the entire meeting is judged to be the winner. No marks are given for flights of less than 15 miles, but pilots may earn bonus marks if they reach a declared destination.

For tasks (1) and (2) five marks are given per mile per hour of ground speed, provided the destination is reached. For tasks (3) and (4) one mark is awarded for each complete mile covered in the direction of the declared goal. One mark is also given for each complete 100ft of climb, provided the total is not less than 1,500ft.

Four of the seven existing British national records in Category I (i.e., for single-seaters) are now held by F/L. A. W. Bedford, A.F.C. These are for distance, gain of height, absolute altitude and goal flight achievements. Mr. Philip Wills holds both the "out-and-return" and "speed over a triangular course of 100 km" records. The duration record is held by Sub-Lt. A. N. Young with a flight of 15 hr 47 mins—an achievement, incidentally, which has remained unsurpassed since 1938.

We hope to publish a full report of this year's contests next week.

NATIONAL GLIDING CHAMPIONSHIPS, 1951

Machine Type	Name of Entrant	Class of Entry	Pilots (* Captain of Team)
Mu 13A	R.N. Gliding and Soaring Association	T	Lt./Cdr. G. A. J. Goodhart*, Lt./Cdr. H. C. N. Goodhart
Olympia (German)	R.N. Gliding and Soaring Association	T	Lt./Cdr. H. C. N. Goodhart*, Lt./Cdr. G. A. J. Goodhart
Weihe	P. A. Wills	I	P. A. Wills
EoN Olympia ...	D. H. G. Ince ...	I	D. H. G. Ince
EoN Olympia ...	T. R. Young	T	T. R. Young*, D. Colvin, G. Foord, A. F. Gotch
EoN Olympia ...	C. J. Arnold	T	C. J. Arnold*, G. H. Lee
EoN Olympia ...	Bristol Gliding Club	T	C. Staffurth*, A. N. Other
Rhon Bussard ...	F. Foster	I	F. Foster
EoN Olympia ...	D. A. Smith	I	D. A. Smith
Weihe	Surrey Gliding Club	I	L. Welch
Sky	E. J. Furlong	I	G. H. Stephenson
Weihe	R.A.F. Gliding and Soaring Association (Home Command)	T	W/C. W. H. Ingle*, A. N. Other
Petrel	S. C. O'Grady and R. C. Pick	T	S. C. O'Grady*, R. C. Pick, A. de Rodder
EoN Olympia ...	H. C. G. Buckingham (Maintenance Command)	I	F/L. A. W. Bedford
EoN Olympia ...	Empire Test Pilots' School	T	S/L. J. A. Sowrey*, P. Bisgood
EoN Olympia ...	Army Gliding Club	T	Maj. A. J. Deane-Drummond*, Lt.-Col. N. J. Dickson
Prefect	Cambridge University Gliding Club	T	R. Prestwich*, S. Neuman, M. Gee, T. Adams
Grunau	R.A.F. Gliding and Soaring Association (Flying Training Command)	T	F/O. I. Ladley*, F/L. J. A. Pressland, F/L. E. C. Rigg
Kranich	R.A.F. Gliding and Soaring Association (R.A.F. College)	T	F/L. D. E. Cooke*, F/L. A. A. Pearce
EoN Olympia ...	Surrey Gliding Club	T	P. Murden*, C. W. Dowdall
EoN Olympia ...	R.A.F. Gliding and Soaring Association (Bomber Command)	T	F/L. J. Archbold*, J. Williamson
Sedbergh T21 B ...	A.T.C. (Home Command)	T	S/L. J. C. Ward*, F/L. Charman-Thomas
Sedbergh T21 B ...	A.T.C. (No. 64 Group (Northern) R.A.F.)	T	F/L. Neubroch*, Sgt. Campion
EoN Olympia ...	London Gliding Club	T	P. Rivers*, J. Currie, A. H. Yates
EoN Olympia ...	London Gliding Club	T	C. A. P. Ellis*, J. Hanks
EoN Olympia ...	Imperial College Gliding Club	T	F. G. Irving*, R. A. B. Macfie
EoN Olympia ...	W. E. Crease	T	J. Grantham*, W. E. Crease, A. L. Alexander, D. R. Clayton
EoN Olympia ...	Surrey Gliding Club	T	D. Scallon*, D. Stevens, Miss M. Gilbert
Kranich	Cambridge University Gliding Club	T	D. L. Martlew*, J. H. Edwards, A. R. I. Austin, T. G. Phillips
EoN Olympia ...	R.A.F. Gliding and Soaring Association (Fighter Command)	T	F/O. P. Mallett*, Sgt. B. Longstaff
Sedbergh T21 B ...	Imperial College Gliding Club	T	Mrs. A. C. Douglas*, P. H. Blanchard
Gull IV	R.A.F. Gliding and Soaring Association (Research and Experimental Gliding Club)	T	S/L. R. H. Smyth*, A. N. Other
Sky	F. N. Slingsby ...	T	F/L. R. C. Forbes*, A. Pratt

Entries are either Team (T) or Individual (I).

SERVICE AVIATION

Royal Air Force and Naval Aviation News

C.F.S. Annual Dinner

THE annual reunion dinner of the Central Flying School has a character all of its own. By virtue of its work—instructing instructors—the C.F.S. is by way of being responsible for the flying quality of the R.A.F. Many officers who have attained high rank have attended the school as pupils, and instructors. It was also the first unit of the R.F.C. and, thus, the annual gathering assumes an importance unequalled by that of any other formation.

The toast of "The Guests" was to have been given by A. Cdre. Selway, the newly appointed Commandant, but he, after a few opening remarks, passed the ball to Air Chief Marshal Sir James Robb. In doing so he very gracefully referred to Sir James' arrival by air for the last time in his famous five-star blue Spitfire 16. Sir James is to retire in September and this final landing came 35 years and three days since he did his first solo, also at C.F.S.

Sir James first asked the assembled company to indicate whether the present arrangement of a dinner held each year was preferred to the formation of a C.F.S. Association with an annual subscription, charities, dinners and a roll of members. The later suggestion was received with cheering and no doubt was left as to which arrangement was preferred.

The Air Chief Marshal then drew a parallel between work of the C.F.S. now and that of the unit between the wars. The object, he said, was the same, but it was on a scale never before attempted in peacetime (850 instructors a year are required).

In a lighter vein he referred to some of the company. Col. Louis Strange, he pointed out, was at C.F.S. before the 1914 war and A. V-Ms. Boyle and Atcherley (R.L.R.), who put up the first inverted flight for the R.A.F. Display in 1928, were both now air officers commanding groups.

Replying for the guests, Marshal of the Air Force Sir John Slessor also paid a tribute to Louis Strange, who was his squadron C.O. when he was first at C.F.S. in 1915. Much of Sir John's speech, however, was of a graver nature and not for general publication. He also broke the news of the assassination of King Abdullah of Jordan, regretting very much the passing of one of Britain's staunchest friends. He spoke of the great tasks that lie ahead in building up the R.A.F. once more, but with a grand note of confidence in his voice, finished by saying, "We shall succeed. There is nothing the Royal Air Force cannot do."

Col. Strange, after pleading sciatica as his sole excuse for not flying down, referred to the Smith-Barry tradition of C.F.S., pointing out that, before S-B's time, flying schools only taught people how to fly. S-B taught people how not to fly. He ended by regretting the curtailment of private flying and the insufficient help given to members of the A.T.C. who learnt to fly.

To meet the expansion requirements the Central Flying School has recently been entirely reorganized and enlarged to embrace three stations—Little Rissington (W/C. A. J. Trumble), South Cerney (G/C. G. W. Hayes) and Moreton-in-Marsh (S/L. J. B. Fleming), with G/C. W. E. Coles as Chief Instructor. The initial training periods on Prentices and the Instructors' Leadership School courses are taken at South Cerney, Harvard and Meteor flying is done at Little Rissington, and the Refresher Squadron is now housed at Moreton-in-Marsh.

The Refresher Squadron gives instruction on single-engine types to pilots rejoining the Service and also to pilots of Bomber, Transport and Coastal Commands.

CONVERSATION PIECES at the C.F.S. dinner. Left to right, A.V-M. R. L. R. Atcherley chats with Air Marshal Sir Hugh Walmsley, the C.A.S., Sir John Slessor, with A. Cdre. Selway and, in the distance, Air Chief Marshal Sir James Robb reminisces with G/C. W. E. Coles.

Culdrose Open Day

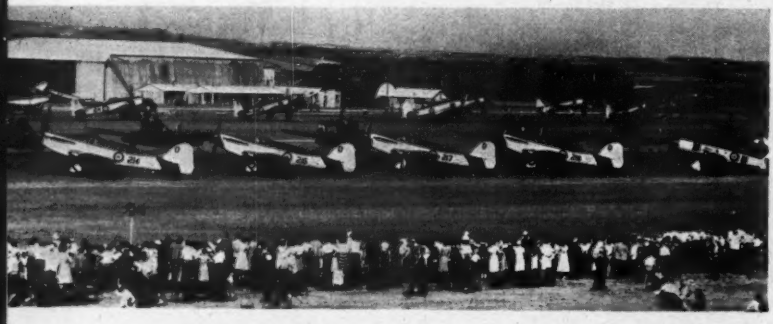
SOME 8,000 visitors attended H.M.S. *Sea Hawk's* open day at R.N.A.S. Culdrose, Cornwall, on Friday last. Weather conditions were perfect. In the handicap race between various naval types including Sea Otter, Firefly, Seafire, Firebrand, Brigand, Sea Hornet, Sea Fury, Vampire and Attacker, it appeared from the finishing times as if the winning Sea Otter had been given a rather too generous time allowance.

For the formation aerobatics by two Sea Hornets and two Sea Furies of No. 52, Training Air Group, the Hornets made an emotioning start by taking off simultaneously from opposite ends of the runway.

Forty aircraft provided an impressive spectacle when eight Fireflies of No. 814 Sqn., and eight Sea Hornets from No. 809 Sqn., left at ten-second intervals to simulate a carrier take-off. These aircraft then made a dummy attack on the airfield before demonstrating a stream landing.

The static display included sectioned examples of Bristol Centaurus and Rolls-Royce Griffon piston engines and a de Havilland Goblin turbojet.

RANGED: Fireflies and Sea Furies all set for the "aircraft carrier" take-off at Culdrose's open day.



Tragedy in Jordan

KING ABDULLAH of Jordan, who was assassinated last week, was a good friend of the Royal Air Force, in which he held the honorary rank of Air Commodore. His friendship with No. 6 Squadron was particularly intimate and the unit has visited him on a number of occasions during the many years which it has spent in the Middle East. Only recently, during a period of desert training at Mafrac, King Abdullah presented the squadron with his royal colours and, in return, accepted an embroidered copy of the squadron's badge.

SERVICE AVIATION . . .

North Pole in College Curriculum

FOR the past week five aircraft of the R.A.F. Flying College, Manby, Lincs, have undertaken a series of navigational training flights, operating from Keflavik, in Iceland. In the course of these exercises *Aries*, one of the Avro Lincolns, flew over the geographic North Pole.

The flight plan for *Aries* allowed for leaving Keflavik at 2 a.m. on July 24th and, after crossing the Pole, to land at the U.S.A.F. base at Eielsen Field, Alaska—a 3,553-mile journey of 17 hours' duration. The return was expected to last 20 hours and would be a non-stop flight of 4,128 miles direct from Alaska back to Manby. W/C. R. T. Frogley, D.F.C., senior instructor at the Flying College, was the captain of *Aries*, with two other pilots, W/C. P. W. Heal, A.F.C., and A. H. Humphrey, O.B.E., D.F.C., A.F.C., included in the crew of ten.

A 2,478-mile triangular course was flown by the remaining aircraft on the exercise, the route being Keflavik—Shannon Island (East Greenland)—Godhaven (on Disko Island, West Greenland)—Keflavik.

The other four Lincolns were captained by W/C. A. D. Frank, D.S.O., D.F.C., S/L. J. T. Lawrence, A.F.C., S/L. R. S. Radley, D.F.C., and S/L. J. C. T. Downey, D.F.C., A.F.C. Ground crews were transported to Iceland by a Hastings in the charge of S/L. E. W. Merriman, M.B.E.

Two Well-earned A.F.C.s.

THE announcement is made of the award of the Air Force Cross to S/L. C. E. L. Hare, D.F.C., and F/L. L. B. Pearson, both of the R.C.A.F. S/L. Hare has been serving with the R.A.F. on exchange and the two incidents mentioned in his citation occurred during this period.

The first of these took place in April, 1949, when he was flying a Halifax adapted to carry a paratechnicon, or special cargo-carrying device, which could be dropped by parachute. Little was known about how this device would affect the handling characteristics of the aircraft. On the first flight one engine failed. S/L. Hare could have jettisoned the paratechnicon, which was not equipped with parachutes on the initial flight, and then made a three-engine landing with little danger. Having regard to the setback which the project would suffer, and the danger to people on the ground, he continued to fly the aircraft on three engines until familiar with its performance, and then made a successful three-engine landing, without damage to the aircraft or the special equipment.

The second item in the citation refers to his conduct while in charge of a Lancaster aircraft equipped with prototype cloud-warning equipment. During the spring of 1950 this aircraft was detached to Singapore for trials. More than 100 flights were made through cumulo-nimbus cloud and 30 flights through thunderstorms where lightning was present. The information obtained is described as invaluable. The citation says "there is no doubt that the example set by S/L. Hare and his determination to fulfil the task to the utmost of his ability contributed largely to the success of the expedition, and his investigations have helped to tear down some of the veils of ignorance which cloud man's knowledge of flying conditions in cumulo-nimbus cloud and thunderstorms."

The citation covering F/L. Pearson's award pays tribute to his work on search and rescue duties, and refers specifically to one incident which took place in June, 1950. On that occasion F/L. Pearson was captain of a Canso amphibian, which flew from Greenwood to Fort Chimo, in the Ungava district, to pick up a boy requiring medical attention. Bad weather forced him to fly solely on instruments. Radio aids were useless because of precipitation static, and severe carburettor icing caused the aircraft's engines to cut out intermittently.

On discovering that the designated landing area was frozen solid far out to sea, he proceeded a further 60 miles north to Emilik where the mouth of a swiftly running river was practically clear of ice and offered a possible landing space. He realized that an attempted landing might end in disaster, because the area of open water was extremely small and surrounded by ice. However, remembering that a boy's life depended entirely on his ability to put the Canso down in the water and take off again, he decided to take the risk.

After landing in the exceptionally confined area it was noticed that the swells caused by the landing were breaking off large pieces of ice which were drifting down towards the aircraft. He positioned two men on the wing and directed them to run from one wing tip to the other, raising the opposite wing-tip floats to allow ice to drift harmlessly underneath. At the same time he had other crew members fend off floating ice with boat hooks and oars, and use sleeping bags as buffers when it was impossible to prevent ice from pressing against the hull. This officer directed his crew with such skill that in the 45 minutes the aircraft was on the water waiting for the boy, no damage was caused by drifting ice. With extremely delicate manœuvring he took off successfully from the treacherous waters and flew his patient southward to hospital.

BACK FOR THE BATTLE: A.V-M. Lord Bandon, A.O.C. No. 11 Group, Fighter Command, greeted the Portuguese pilots on their arrival at Tangmere last week with the Hurricanes which are being loaned for the Battle of Britain film "Hawks in the Sun." (Left to right) W/C. T. B. de la P. Beresford, G/C. T. O. Prickett, Lord Bandon, Col. L. Pina, Lt. Pinto, Lt. de Lemos, Lt. J. Mirando, Lt. J. Fernandes and Sgt. Orvalno.

U.S. Awards for R.A.A.F.

THE American D.F.C. has been awarded to five pilots of No. 77 Squadron, R.A.A.F., for service in Korea. The recipients are: P/O. D. C. Ellis (missing, believed killed), F/L. G. R. Harvey (missing), P/O. L. R. Klaffer, P/O. G. I. Stephens (missing, believed killed) and W/O. A. R. Turner. The late W/C. L. T. Spence, D.F.C., receives the Legion of Merit.

"No. 5 Bomber Group R.A.F."

THE war-time history of No. 5 Bomber Group, by W. J. Lawrence, is now available. Writing of the book, Marshal of the Royal Air Force Sir John Slessor says: "There have appeared in recent years many accounts of man's heroism on land, at sea and in the air during those six grim years. None of them can surpass the story of what all of us who served in it, and not we alone, may be excused for regarding as the pick of a glorious company, No. 5 Group of Bomber Command. The Group were the pioneers of sea mining from the air. Long before the days of the Special Pathfinder Group, Group 5 were developing their own special marker technique—primitive and crude, and not very successful: but it was the seed of what was later to become the flower of Bomber Command's success in later days when the right equipment became available. . . .

". . . There has never been a finer story of skill and heroism than that of the epic raid on the Möhne and Eder dams by Guy Gibson and 617 Squadron on the night of May 16th-17th, 1943. This, of course, was a picked unit. But Nettleton at Augsburg, Reid—twice wounded, his navigator dead and his engineer and signaller both wounded—pressing on to the target at Dusseldorf, these and a thousand others (many of them still serving) were of the same tradition. No. 5 Group were always a team, from the headquarters at Grantham to the A.C.2 on the dispersal site—not forgetting the Met. section under Mr. Mathews and the "Gremlin," whom Sir Ralph Cochrane so rightly mentions in his excellent foreword."

No. 5 Bomber Group, R.A.F. was reviewed in *Flight*, June 15th, 1951. It is published by Faber and Faber, Ltd., price 15s.

Reunions

THERE will be a gathering in London of ex-members of No. 164 Squadron on October 13th. Mr. J. R. Black, 13, Hampden Road, Harrow Weald, Middlesex, is the organizer.

No. 1409 (Met) propose to hold another reunion at the Pathfinder Club on October 6th. Details from E. R. Perry, 17, Pimlico Road, London, S.W.1.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Flight Simulators

MR. HINING'S letter in *Flight* (July 13th) prompts me to ask: Is a flight simulator an instrument for teaching the uninitiated to fly, or is it an instrument which is fed with flight conditions at one end and produces the answer at the other?

Walton. F. H. SMITH.

R-F. Seats for Airlines

THE somewhat meretricious attention given by the lay Press to the report on the Mill Hill Dakota crash was regrettable but, perhaps, natural in the circumstances. There are several points on which one feels issue might be taken with the report, but it is with the matter of rearward-facing seats that I am chiefly concerned.

Most impartial, but interested bodies (such, for example, as the Air Registration Board, the R.A.F. Institute of Aviation Medicine and, I believe, *Flight*) advocate the use of rearward-facing seats. The airlines state that passengers do not like such seats. On what grounds is this statement made? Has a Viking or a Constellation been fitted with r-f seats throughout and have passengers refused to fly in such aircraft? Of course not. The truth is that r-f seats need to be stronger, and need to be anchored more strongly to a stronger floor than applies with the conventional forward-facing seats; and strength of this order means more metal, which means less payload. So a safety measure which everyone recognizes and many openly advocate is evaded by the airlines on what are really economic grounds.

To bolster up the evasion, the excuse is made that it has not yet been determined what strength will be needed for rearward-facing seats, anchorages and floors. So what? Is this justification for delay? I submit that if the strength characteristics of the present seats and floors were to be doubled, the increase in structural weight would not be such as to diminish the payload by more than the weight of perhaps two passengers per aircraft. And this becomes of economic importance to the operator *only* when the aircraft has a 100 per cent load factor. In any case, even if the payload reduction was greater than this, it surely does not justify the evasion of such a safety measure. Pounds, shillings and pence are incongruous counterweights to human life in the scales of justice.

I am extremely reluctant to advocate that the way the airline operator chooses to run his business should be subject to official interference. I do not even know whether the Ministry of Civil Aviation has the power to compel B.O.A.C. and B.E.A. to fit rearward-facing seats in Corporation aircraft. But I do most emphatically suggest that if the Corporations do not take it unto themselves to modify their aircraft to rearward-facing seats (by the end of this year, say) they should be forced so to do by Government decree.

C. H. STANHORE.

London, W.5.

Flying Through the Grand Canyon

MY friend Sir Frederick Tymms is quite right in what he says about the photograph of the Boulton Paul Balliol flying along the Grand Canyon of the Colorado River published in your issue of June 15th. It is the colour photograph on the cover of your edition of July 13th, also taken by Squadron Leader Sowrey, which shows the Balliol flying below the lip of the Canyon at 7,000 feet. This was, of course, an altimeter reading.

I can confirm what Sir Frederick says about the impressive nature of the scenery. In 1942, when I was a member of the mission which went to the States to study American aircraft production methods, the United States Navy Department made available to us a high-wing Douglas aircraft (I think this was a DC-5), and the naval pilot took us for a memorable half hour's exploration through the Canyon.

Although with this method of presentation the picture changes with bewildering rapidity, it does give a comprehensive idea of the most striking and colourful formation of this wonder of nature, which is not normally obtainable from the view on the civil air route, although the pilots of T.W.A., on standard flights, do very obligingly, bring their passengers down to a fairly low altitude.

Wolverhampton. JOHN D. NORTH.

RADIO FOR NAIROBI

A CONTRACT has been placed with Standard Telephone and Cables, Ltd., for the supply of equipment for the Royal Air Force station at Nairobi. The equipment ordered includes 19 short-wave radio transmitters of three types with powers of 4 kW, 5 kW and 40 kW respectively, together with associated drive units, monitoring and remote-control equipments. The total power of this station will be 369 kW and each of the 19 transmitters will have two R.F. trucks permitting separate transmissions on different wavelengths. The transmitting facilities available will be: Independent side-band, single side-band, double side-band and frequency shift keying.

Remote-control facilities are being provided by means of a time-sharing Multiplex, type D.F.1, giving 48 operating channels.

The station will, it is stated, be in a position to handle every type of radio communication—telephony, telegraphy and teleprinter—and so will constitute the most up-to-date, and probably the largest, service telecommunication centre outside the British Isles.

HIGH-POWER SNOW CLEARANCE

THOUGH the news may sound a little unseasonable in July, it is not without interest that an order for a number of rotary snow-ploughs has been placed by the Air Ministry with a London firm. The recipients of the order are J. J. Johnson and Co., Ltd., 271, Uxbridge Road, London, W.12, who recently supplied two small ploughs to the Ministry of Civil Aviation.

The new order is for machines of a large type—the Bros Sno-Flyr, hitherto only obtainable from America for dollars. British production of this plough has, it is stated, been made possible through a manufacturing agreement between J. J. Johnson and the Bros Company of Minneapolis, and the complete units, comprising ploughs and carriers, are being produced at the works of Steels Engineering Products, Ltd., Sunderland.

The modern truck-mounted rotary snow-plough, it is claimed, has proved itself to be the most efficient method of rapidly clearing snow from military and civil airfields, whether used alone or in conjunction with blade ploughs. These machines are also capable of opening up roads where snow has drifted to a depth of 15 ft or more and, if required, for loading "windrowed" snow into trucks.

The ploughs to be supplied to the Air Ministry are exceptionally powerful units. Two Meadows six-cylinder petrol engines each developing 135 b.h.p. will supply the power for the ploughing motions. In the Bros design a double-vee "mouldboard" is used, carrying two large-diameter rotors which throw the snow through dissipating chutes to a distance of from 75 to 150 ft. First contact with the snow or ice is made with a feeder "rake" which moves in an arc from ground level to a height of 8 ft 3 in, permitting the undercutting of high banks.

The special four-wheel-drive carrier, which Steels Engineering Products are producing for the purpose, is powered by another Meadows 135 b.h.p. engine identical and interchangeable with the two ploughing engines.

FORTHCOMING EVENTS

July	21-29.	National Gliding Championships, Camphill, Gt. Hucklow Derbyshire.
July	27-29.	Royal Netherlands Aero Club: Ypenburg Rally.
July	28.	Royal Engineers' Flying Club: Air Day, Rochester.
July	29.	Columbus Centenary Rally, Genoa.
Aug.	4-5.	Aero-Club de Touraine: International Rally, Tours, France.
Aug.	6.	*Daily Express* Challenge Trophy International Air Race, Shoreham Airport, Sussex.
Aug.	11.	Leicestershire Aero Club: Rally and Display, Leicester East Airfield.
Aug.	12-18.	International Air Circuit of Switzerland.
Aug.	18.	Wiltshire Flying Club: Thruxton to Isle of Wight Air Race.
Aug.	18-19.	U.S. National Air Races, Detroit.
Aug.	19.	Yorkshire Aeroplane Club: "At Home" (sponsored by A.B.A.C.).
Aug.	25.	Exeter Aero Club: Display.
Aug.	25-26.	Skegness Airport: Aerial Week-end.
Aug.	25-26.	International Air Circuit of the Dolomites, Italy.
Sept.	1.	R.N. Air Stations Gosport and Lee-on-Solent: Air Display.
Sept.	2.	A.B.A.C. Summer Convention.
Sept.	3-7.	R.Ae.S. and I.Ae.S.: Third Anglo-American Aeronautical Conference, Brighton.
Sept.	3-8.	International Congress of Astronautics.
Sept.	9.	Society of Model Aeronautical Engineers: Model Flying Festival, Sherburn-in-Elmet.
Sept.	10-16.	Battle of Britain Week.
Sept.	11-16.	S.B.A.C.: Flying Display and Exhibition, Farnborough.
Sept.	15-16.	International Rally, Parme, Biarritz, France.
Sept.	25.	Milan International Grand Prix.

Midland Bank

Services

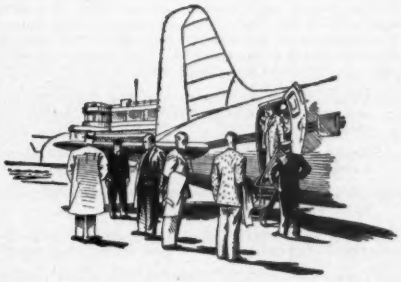
for those

who travel by air

As part of the policy of making banking services available wherever they are needed, the Midland Bank has established branches in the passengers' arrival halls of the principal airports. A complete banking service is provided at these offices, including facilities for foreign exchange and other special requirements of the traveller.

Midland Bank Airport Branches are at:

LONDON AIRPORT NORTHOLT
CROYDON MANCHESTER



WEYBRIDGE 'S' COVERING

The Weybridge 'S' Covering is undoubtedly the finest finish available for wooden propellers—and the Weybridge Propeller has a second-to-none reputation. Together they make the toughest, longest-lived light plane propeller available today. The 'S' Covering gives the thoroughly efficient Weybridge blades extra strength to go on giving safe service for longer periods without maintenance. It seals out moisture, resists abrasion and stays 'airworthy' through constant flying in the worst conditions. Another Airscrew 'Service to Aviation.'

THE

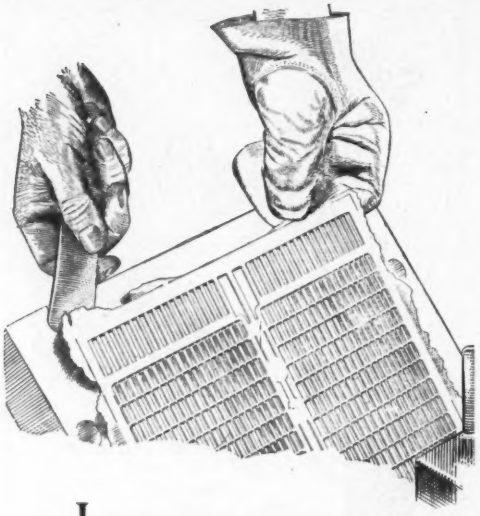
AIRSCREW

CO., & JICWOOD LTD., WEYBRIDGE, SURREY

Telephone: Weybridge 1600 Telegrams: Airscrew, Weybridge

Manufacturers of: Fixed Pitch Propellers. Weybridge Blades. Engine test fans. Wind tunnel fans and blades. Wind tunnels. Smoke tunnels. Recirculating fans for pressurised cabins. Axial-flow and centrifugal fans. Sheet metal work for the aircraft industry. Weyroc man-made timber and block flooring. Jicwood Bus Roof. Jicwood Insulated Transit Containers. Insulated Materials. Specialists in stressed-skin construction for aircraft.

the future in their hands . . .



In every stage of battery production, skilled hands are constantly at work, controlling and assisting the many varied processes used in manufacture. The owners of these hands are men who are shaping a new future in the field of electrical storage, keeping Oldham batteries abreast of all the latest developments and ensuring even more 'Power to Spare' for the aircraft battery of tomorrow.

OLDHAM

AIRCRAFT BATTERIES
with Power to Spare

OLDHAM & SON LTD · DENTON · MANCHESTER
EST. 1865

AIRCRAFT ANCILLARY EQUIPMENT

The largest Suppliers in Great Britain of American and British Aircraft Ancillary Equipment to all the leading Aircraft Manufacturers. All materials can be supplied A.R.B. or A.I.D. released.

We can offer ex stock, both British and American:

Flight and Navigation Instruments. Auto Pilots
Voltage Regulators and Reverse Current Relays
Radio and Intercommunication Materials
All types of Ground Equipment
Landing & Navigation Lamps
Breeze Plugs and Sockets
Cameras and Control Gear
Armament & Bomb Gear
Aircraft Generators
Magnetic Relays
Alternators
Filaments

We have also large stocks of AGS and AN Hardware

Central Depot

MAGALOW TRADING CO.

Contractors to the Ministry of Supply, the Dominions and to Foreign Governments

27/39 BROADLEY TERRACE, LISSON GROVE, LONDON, N.W.1

Telephone:	*Telegrams:*	*Cables:*
AMBassador 7013	MAGALOW NORWEST LONDON	MAGALOW LONDON

OPPORTUNITIES EXIST FOR YOUNG DESIGNER/DRAUGHTSMEN AND ENGINEERS AT BRITISH MESSIER

on interesting work on various types of hydraulic and electric devices. General office conditions are agreeable, ingenuity and merit being appreciated and acknowledged. The average age is not great. The works is situated halfway between Cheltenham and Gloucester. Applicants with particular interests should write personally, as indicated below, stating age, experience and salary required.

(a) Design of hydraulic pumps including centrifugal types and steam turbine drives. Write to Mr. G. Orloff, Chief Designer.

(b) Design of small high pressure hydraulic and electro-hydraulic components. Write to Mr. G. Orloff.

(c) Design of hydraulic servos for aircraft and special projects. Write to Mr. G. Orloff.

(d) Design of test rigs for undercarriage and hydraulic equipment. Write to Mr. R. J. Brown, Chief Draughtsman.

(e) Design of equipment for development of new technique for welding high tensile steel. Write to Mr. J. J. Wilson, Works Manager.

(f) Test and research work on items (a), (b) or (c). Write to Mr. G. Orloff.

BRITISH MESSIER LIMITED

Cheltenhan Road East Gloucester

FLIGHT and AIRCRAFT ENGINEER

PRESS DAY—*Classified advertisement "copy" should reach Head Office by* FIRST POST THURSDAY *for publication in the following week's issue subject to space being available.*

CLASSIFIED ADVERTISEMENTS

Advertisement Rates. 4/- per line, minimum 8/-, average line contains 6-7 words. Special rates for Auctions, Contracts, Patents, Legal and Official Notices, Public Announcements, Tenders 5/- per line, minimum 10/-. Each paragraph is charged separately, name and address must be counted. All advertisements must be strictly prepaid and should be addressed to FLIGHT Classified Advertisement Dept., Dorset House, Stamford Street, London, S.E.1.

Postal Orders and cheques sent in payment for advertisements should be made payable to Iliffe & Sons, Ltd., and crossed & Co.

Trade Advertisers who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

Box Numbers. For the convenience of private advertisers Box Number facilities are available at an additional charge for 2 words plus 1/- extra to defray the cost of registration and postage, which must be added to the advertisement charge. Replies should be addressed to "Box 0000, c/o Flight," Dorset House, Stamford Street, London, S.E.1.

The Publishers retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

AIRCRAFT FOR SALE

FIELDS

DAKOTAS!

DAKOTAS!!

DAKOTAS!!!

STILL a few left. We don't have to tell you how quickly these aeroplanes sell, nor how few there are remaining. Do not delay your enquiries or you will almost certainly be disappointed.

We can also supply most other types, large and small.

PHONE your enquiries or write to: Field Aircraft Services, Ltd., at Croydon Airport. Tel.: Croydon 7777. Cables: Fieldair, Croydon. [0259

R. K. DUNDAS, Ltd.

THERE is no doubt that we can supply better aeroplanes at cheaper prices than any other country at the moment. This is because there are still more aircraft here than the home market can absorb. Just as ornithologists know the truth in the saying "The higher the fewer," aviators will appreciate the sense of "The fewer the higher."

THEREFORE we strongly advise you to send for our list and buy your aircraft now.

AEROPLANES by Dundas.

R. K. DUNDAS, Ltd.

DUNDAS, Ltd., 29, Bury Street, London, S.W.1.

WHI. 2848. Cables: Dundassero, Piccy, London.

CROYDON AIRPORT. Cro. 7744. Ext. 322 and 325. [0569

CENTRAL AERONAUTICAL BUREAU, Ltd.

WE have a few space-ships for sale, all with low light-years on motors and hulls. These can be inspected "as lying" on Venus, or can be viewed from Greenwich, by arrangement.

THUS will run C.A.B.'s ad. of the future. But, coming down to Earth, we can offer today the following selection from which to choose: Proctor Vs (two), Proctor IIIs (three), Rapides (five), Avro XIXs (two), Aerovans (one), Tiger Moths (two), Consuls (two), Ansons (three), Austers (three), B.A. Swallows (two), Lancastrians (two), Geminis (two), Messengers (one), Miles Hawks (two).

CENTRAL AERONAUTICAL BUREAU, Ltd., Croydon Airport, Surrey. Cables: Centralair, Croydon. Tel.: Croydon 3393. [0620

VENDAIR AIRCRAFT SERVICE AND SALES offer one Beechcraft Expeditor C185, six passenger seats, automatic pilot, full radio.—Vendair, Croydon Airport. [0603

FOR SALE. Moth Minor in good condition. Engine hours low.—Replies Box 3036, or phone Gulliver 3314. [0703

PROCTOR V, standard, exceptional condition, less than 220 hours since new, completing C. of A. overhaul now. £675.—Air Couriers, Ltd., Croydon Airport. [0687

FAIRCHILD Argus with C. of A., low engine hours. Re-upholstered and soundproofed by Rumbold. Radio and B/F panel. Nearest £500 secures.—Box 3008. [0695

£995 Anson Mark 1 Freighter. Early delivery, with 12 months C. of A. Fully modified, with low hours both airframe and engine. Payload 1,845 lb. Seven passenger seats can be fitted if required.—Box 3009. [0696

MESSRS. BROOKLANDS AVIATION, Ltd., have two Rapides and two Proctors for sale, all in excellent condition.—Details on request from the Manager, Civil Repair Service, Sywell Aerodrome, Northampton. Tel.: Moulton 3251/2. [0691

MESSENGER, Gipsy Major I.D., C. of A. until March, 1952; airframe 350 hours, engine 70 hours, full blind panel, colour light blue. £1,400. Exchange plane or car. Mountview 8756. Turner, 17, Langbourne Mansions, Hillway, London, N.8. [0620

FOR sale. Auster Autocrat in brand new condition. Year's C. of A. Long-range tank. Best offer secures, or exchange good car. Cash adjustment up to £1,000 for exceptional car. Owner will give flying delivery to any part of the world.—Box 2108. [0495

£650 MILES Whitney Straight, full dual, full blind flying. Just completed top overhaul, including modified heads. Upholstered blue leather. A delightful aeroplane. Would exchange modern car.—Tel. H. Brown, Reading 2237. [0703

AIRCRAFT FOR HIRE

HIRE and fly yourself.

WE have a Fairchild Argus and several Piper Cub Special aircraft available for hire. Inclusive charge 84 17s. 6d. and 82 15s. per hour respectively, covering hire of aircraft, petrol, oil, insurance, etc.

A. J. WALTER, Gatwick Airport, Horley, Surrey. Tel.: Horley 1510 and 1420. [0711

MARK VIII GOGGLES, brand new, fitted clear safety lenses and complete with spare pair of tinted lenses, 22/6. Post 6d. Spare lenses, tinted, 5/-, or clear 7/6 per pair. LUXOR GOGGLES, 55/-. LEATHER FLYING HELMETS, suitable for acoustic or electrical intercom. 27/6. White Drill Ground-crew OVERALL, buttoned front, 43/-. R.A.F. Outer FLYING SUITS, new, 52/6. **Special Offer, 22** pairs only, brand new sheepskin-lined, brown suede, zip-front FLYING BOOTS, 89/6. IRVIN FLYING JACKETS in stock. Waterproof ¾ length FLYING JACKETS Kapok lined, with luxurious Fur Collar 59/6

TERMS TO FLYING CLUBS. TRADE SUPPLIED. SEND 3d. IN STAMPS FOR ILLUSTRATED CATALOGUE.

D. LEWIS LTD. (DEPT. F.)

Leather Clothing Manufacturers for Home or Export

124 GT. PORTLAND ST., LONDON, W.1.

Trade Inquiries Invited.

Tel.: Museum 4314. Tele.: Aviakit, Wesdo, London

Aero & Jig & Tool Draughtsmen in Great Demand

MEN & YOUTHS

There is an insatiable demand for Aero, Jig and Tools, etc., Draughtsmen and Inspectors. So acute is the present shortage that employers are only too anxious to engage those with no previous practical experience who are able to prepare neat and accurate drawings.

QUALIFY AT HOME—IN SPARE TIME

After brief, intensely interesting study—undertaken at home in your spare time—*YOU* can secure an attractive and interesting post as **Aero-Draughtsman.** Numerous vacancies are also available in **Electrical, Mechanical, Plastics,** etc., branches of Draughtsmanship.

FREE GUIDE

The Free Guide contains 132 pages of information of the greatest importance to those seeking such success compelling qualifications as **A.M.I.Mech.E., A.F.R.Ae.S., A.M.I.P.E., A.M.I.M.T., Gen. Cert. of Educ., and B.Sc.,** etc., also **R.A.F. Entry** (Maths., etc.), together with particulars of our remarkable Guarantee of

SUCCESS—OR NO FEE

Write now for your copy of this remarkable publication. It may well prove to be the turning point in your career.

NATIONAL INSTITUTE OF ENGINEERING

(Dept. 427), 148-150, HOLBORN, E.C.1

(South Africa Branch E.C.S.A., P.O. Box 8417, Johannesburg).

AIRCRAFT FOR SALE

WS.

SHACKLETON, Ltd., 175, Piccadilly, London, W.1.

EUROPE'S leading aeroplane dealers (20 years at this address), give below a general indication of present prices of the aircraft in most popular demand.

DOUGLAS DAKOTAS and D.H. DOVES have increased in value enormously in the past 12 months (Dakotas have almost doubled in value), but the prices of other planes are still very depressed.—In many cases they can be bought for only 5 to 10 per cent. of the present cost of manufacture.

THE values given below are for aircraft with new or long-term Certificates of Airworthiness:

AVRO ANSONS. £900-£1,500.

AVRO 19. £2,750- £4,000.

D.H. RAPIDES. £1,000-£2,000.

AIRSPEED CONSULS. £900-£1,500.

PERCIVAL PROCTOR V's. £550-£850.

PERCIVAL PROCTOR III's. £250-£425.

AUSTER AUTOCRATS. £445-£900.

FAIRCHILD ARGUS. £300-£550.

MILES MESSENGER. £895-£1,450.

MILES GEMINI. £1,300-£2,000.

MILES WHITNEY STRAIGHT. £450.

MILES MAGISTER. £275-£375.

D.H. TIGER MOTHS. £365-£700

MILES AEROVANS. £475-£800.

TIPSY TRAINERS. £295-£350.

B.A. SWALLOWS. £220-£275.

TAYLORCRAFT PLUS "D". £295-£275.

PIPER COUPE. £295.

D.H. MOTH MINOR. £245.

W.S. SHACKLETON, Ltd., 175, Piccadilly, London, W.1.

TEL. Regent 2448/9. Overseas Cables: "Shackhud, London." [0070

AIRCRAFT WANTED

MILES Gemini, full panel, low hours, landing and navigation lights, dual control.—Box 3005. [0692

W.S. SHACKLETON, Ltd., have instructions to supply several Dakotas. Our clients will pay good prices for approved aeroplanes and we invite owners anywhere in the world (sterling area) to send us full details and prices.

W.S. SHACKLETON, Ltd., also wish to purchase for immediate cash, one or two really good Autocrats and Messengers.

W.S. SHACKLETON, Ltd., 175, Piccadilly, London, W.1. Tel.: Regent 2448. [0071

AIRCRAFT ACCESSORIES AND ENGINES

AIRCRAFT bulbs, fuses, switches, instruments, radio parts and numerous other accessories, British and American. Suplex Lamps, Ltd., 239, High Holborn, W.C.1. [0030

HOME and overseas aircraft operators, don't waste time and money unnecessarily if in need of British and American instruments, electrical accessories and ancillary equipment: first contact:

LITCO FLIGHT AIDS, Station Approach, Boxmoor, Herts. Tel.: Boxmoor 1564. Grams: "Litco Flight Aids, Boxmoor, Herts." [0613

VENDAIR AIRCRAFT SERVICE AND SALES have for sale P. and W. 1830-92, P. and W. R.985, Queen III, Queen II, Gipsy Major, Lycoming 130 h.p., etc.—Vendair, Croydon Airport. [0607

AIRCRAFT SERVICING

F. G. MILES, Ltd., Redhill Aerodrome, Surrey. Nutfield Ridge 2200.

AN approved design, maintenance and repair organisation staffed by experts on Miles aircraft. Major and Minor modifications a speciality; radio installations.

APPROVED instrument test shop; specialists in race preparations.

F. G. MILES, Ltd., Redhill Aerodrome, Surrey. Nutfield Ridge 2200. [0591

BROOKLANDS AVIATION, Ltd., Brooklands Aerodrome, Weybridge. C. of A. overhauls, modifications and conversions. Tel.: Byfleet 436. [0305

REPAIRS and C. of A. overhaul for all types of aircraft. Brooklands Aviation, Ltd., Civil Repair Service, Sywell Aerodrome, Northampton. Tel.: Moulton 3281. [0307

WESTMINSTER AIRWAYS SERVICING, Ltd., contract maintenance and C. of A. overhauls of all types of aircraft at competitive rates: Dakota specialists.—Blackbushe Airport, Camberley, Surrey. Tel.: Yateley 2042. [0612

CARAVANS

A CARAVAN seeing is believing!

STEPHEN JENKINSON (ex-editor caravan paper, living in van himself 13 years) claims he has more vans for sale than anyone else. (And good ones, too.) So why not have a look round and find out whether he's a liar? And every van is guaranteed unconditionally for a year (and more if you're nasty!), with a unique free-van-loaned-for-a-faulty-one guarantee. He likes part exchanges. Sites guaranteed by C.R.A. of which he is the secretary. No better but equal hire purchase terms. So why not write for your free 1 lb. of advice articles and brochures to Head Office: A. S. Jenkinson, Bath Road, Taplow, Bucks. Phone: Maidenhead 3434/5/6. Always open. Easy to reach —right on Main A4. Outskirts Maidenhead. Taplow Station 4 minutes. Equal Selection London Branch: A. S. Jenkinson, 62, Oxford Street (corner Rathbone Place), W.1. Langham 5060?. Two minutes from Tottenham Court Road Tube Station. Open till 8 p.m. 7 days a week. [0500

W. L. CARAVANS, Ltd., hold the finest selection of caravans for homes and holidays.

DISTRIBUTORS and Agents for Willerby, Winsome, Jubilee, Brush Fell, Sunbeam Eagle, Marlow Tudor, Premier, Marston Investor, etc.

PRICES to suit all pockets. Easiest terms. Write, phone or call for full particulars. Open weekdays and Sundays.

BLUE STAR GARAGE, Maidenhead, Berks. Tel. 2747. [0636

CARAVANS. Berkeley range from £399/10/-; Glider Flyte two- and four-berth, £312 and £340; Safari 4, £368. Towing, hire purchase, accessories.—Particulars from Mantle's Garages, Ltd., Biggleswade. Tel 2113. [0367

CARAVAN hunting done with Huntingdon! See them all, Berkeley, Raven, Marston, Eccles, Westway, Sunbeam, Paladin, etc. See the wonderful Willerby range. —Visit Francis Huntingdon Caravans, Ltd., Brighton Road, Coulsdon, near Croydon. Uplands 5901. Open daily to dusk. [0705

ALWAYS open. Largest caravan stock in the North. Forty models by leading makers in great variety on display. Residential mobile homes and touring models from £210. Revelation of refinement and personal comfort. All guaranteed. British and Continental sites reserved for you. Lowest prices, best H.P. terms.—Stafford and Co., Caravan Specialists, Bus Terminus, Kirkheaton, Huddersfield. Phone 4004. Members C.D.A.A. [0666

CLOTHING

R.A.F. and R.N. officers' uniforms purchased; large selection of R.A.F. officers' kit for sale, new and reconditioned.—Fisher's Service Outfitters, 68-98, Wellington St., Woolwich. Tel.: Woolwich 1055. [0667

CLUBS

REDHILL FLYING CLUB.

LEARN to fly at Redhill Aerodrome, Surrey. South London's nearest flying centre, 23 miles from Hyde Park Corner. £3/10/- per hour dual from £2/10 solo; instrument flying, instructors' and advanced courses. Attractive clubhouse with full catering facilities. Tel.: Nutfield Ridge 2245.

REDHILL FLYING CLUB. [0347

HERTS AND ESSEX AERO CLUB, Broxbourne Aerodrome, Nazeing, Essex. M.C.A. approved 30-hour course; solo flying from 30/- per hour; residential; trial lesson 35/-; train from Liverpool St., or Green Line Coach 715.—Tel.: Hoddesdon 2453, 2421, 3705. [0230

CONSULTANTS

WING COMMANDER R. H. STOCKEN, F.R.Ae.S., Eagle House, 109, Jermyn St., London, S.W.1. Tel.: Whitehall 8063. [0419

FIRE FIGHTING EQUIPMENT

FIRE protection by modern methods.—Write for booklet FEFAE to: National Fire Protection Co., Ltd., Essex Works, Fagge Rd., Feltham, Middx. Tel. Fel. 3431. [0580

HOTELS AND ACCOMMODATION

ROYAL OAK HOTEL, Keswick-on-Derwentwater. Heart of English Lake District, offers restful holiday to Air Force personnel; first-class accommodation at reasonable charges. [0414

INSURANCE

ALL types of aircraft insurance and personal accident cover.—Apply to J. W. T. Amey, Messrs. R. J. Moffat and Co., Percy House, 796, High Rd., Tottenham, N.17. Tottenham 3000-4-5. [0584

MISCELLANEOUS

MINIATURE steam loco and tender, 10½in. gauge, for sale.—Box 2708. [0629

PACKING AND SHIPPING

R. AND J. PARKS, Ltd., 143/9, Fenchurch St., E.C.2. Tel.: Mansion House 3083. Official packers and shippers to the aircraft industry. [0012

PATENTS

THE proprietor of British Patent No. 602907, entitled "Engine performance indicating means" offers same for license or otherwise to ensure practical working in Great Britain. Inquiries to Singer, Stern and Carlberg, 14E, Jackson Blvd., Chicago 4, Illinois, U.S.A. [0642

RADIOS

TR. 1143, 4-channel v.h.f. Radio, released, in perfect condition, complete with crystals. £25. Box 0945. [0000

REUNIONS

14 SQDN, 1940-50 aircrew. Reunion 7.30, August 4. Russell's Scotch Stores, opp. London Hippodrome. [0706

TIME RECORDERS

STAFF item checking and job-costing time recorders (all makes) for quick cash sale; exceptional condition. —Box 7241. [0040

TUITION

DUAL and solo Austers, M.C.A. approved. Weekdays, 41/6; week-ends, 51/6.—Elstree 3070. [0702

LEARN to fly for £24; instructors' licences and instrument flying for £3 an hour; night flying £3/10/- an hour; residence 4½ gns. weekly. Approved M.C.A. private pilot's licence course. Wiltshire School of Flying, Ltd., Thruxton Aerodrome, Andover, Hants. [0283

AERONAUTICAL engineering. Full-time practical and technical training. Entrance by means of probationary term. Syllabus from the Secretary, College of Aeronautical and Automobile Engineering, Sydney St., Chelsea, S.W.3. Flaxman 0021. [0016

We're International...

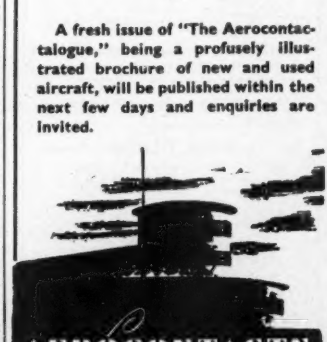
... Throughout our business, covering all manner of aircraft supplies, our activities are very much an international affair, and this is becoming equally true in the Aircraft Sales Department. We are doing considerable business buying from one foreign country and selling to another, and making similar transfers on the normal commission basis. It will be appreciated that this is rather a tricky business in these days of forests of regulations bound up by red tape but, nevertheless, it can be done and, in fact, IS being done. We are therefore keen to have details of all aircraft on offer wherever they may be, and more especially of British and American types, with the accent on "American."

Naturally the major part of our Aircraft Sales are made direct from home sources, and we are equally anxious that we should be kept informed if YOU are considering selling your machine, as a discerning buyer knows by now that a call on AEROCONTACTS will solve his problems.

Our Radio, Electrical, Instrument and Major Components Sales Departments are also at your service, as is our Approved Electrical Overhaul Shop, which, though grossly overworked, can always find that extra capacity to give your urgent jobs a quick turnround.

●

A fresh issue of "The Aerocontactalogue," being a profusely illustrated brochure of new and used aircraft, will be published within the next few days and enquiries are invited.



TUITION

LONDON SCHOOL OF AIR NAVIGATION (1949), Ltd.

PERSONAL COACHING for Commercial, Instrument Rating, Senior Commercial, A.L.T.P. (conversion thereto) and Flight Navigator Licences. This School provides the most rapid and economical method of qualifying. I.C.A.O. standards.

COMPLETE "STUDY-AS-YOU-WORK" courses. Simulates classroom instruction; Lesson, questions, model answers. Unique in application. Ideal those employed or seeking career from Services.

LINK INSTRUCTION AND R/T for all Instrument Rating procedures. Any form of flying training at best quotations. Brochure with terms: 8-10, King St., London, W.6. (Riv. 7400.) [0277

SOUTHEND MUNICIPAL FLYING SCHOOL, Southend-on-Sea, Essex. Tel.: Rochford 56304. Comprehensive flying training. Private and commercial licences from £3 per hour or on contract from £2 per hour on Auster aircraft. Dart Kitten, £1/10/- per hour. No entrance fee, no subscription. Write for full particulars. [0332

A.F.R.Ae.S., A.R.B.Certs., A.M.I.Mech.E., etc., on "no pass, no fee" terms: over 95% successes. For details of exams. and courses in all branches of aeronautical work, navigation, mechanical eng., etc., write for 176-page handbook free.—N.I.E.T. (Dept. 702), 17, Stratford Place, London, W.1. [0707

SCHOOL OF NAVIGATION, University College, Wardsash, Southampton. Flight navigator's course, £16/10/- for six months' tuition; pilot licences, £7/10/- to £13/10/- for six months' tuition; Link instruction: all approach systems, 10/- per hour or £3/10/- for ten hours; postal course; all of residence. Tel.: Locks Heath 2161. [0527

MARSHALL'S FLYING SCHOOL OF CAMBRIDGE. M.C.C.A. approved courses (30 hours) for the private pilot's licence on Tiger Moth or Auster aircraft at £2 per hour; flying training for the commercial pilots' licence and instructor's endorsement; aircraft also available for aerial photography and air charter; no entrance fees or subscriptions. The Airport, Cambridge. Tel. 58261 (Ext. 5). [0568

THE SCHOOL OF AIR NAVIGATION, A.S.T., has a staff of expert instructors, the majority of whom graduated at the Empire Navigation School. Ground courses of all descriptions, including those for airline transport pilot, flight navigator, senior commercial and commercial pilot, instrument endorsement and so on, are available in the school.—For full particulars, apply: The Commandant, Air Service Training, Hamble, Hants. [0227

SITUATIONS VACANT

THE DE HAVILLAND AIRCRAFT Co., Ltd.

HAVE vacancies for

SENIOR design and intermediate draughtsmen (preferably with aircraft experience) in their Hatfield and London (Regent Street) offices.

APPLICATIONS, stating age, experience and salary required, to:

CHIEF Draughtsman, The de Havilland Aircraft Co., Ltd., Hatfield, Herts. [0633

HANDLEY PAGE, Ltd., have vacancies for:—

AERODYNAMICISTS with first- or second-class Hon. degree and preferably with a minimum of three years' experience.

WIND tunnel technicians with first- or second-class Hons. degree and with experience in or preference for wind tunnel work.

SENIOR design and intermediate draughtsmen, preferably with aircraft experience, for their Cricklewood and Radlett offices. Consideration will be given to applicants with experience in light structural or mechanical engineering. Possession of O.N.C. or H.N.C. (Mech. or Elect.) an advantage.

LOFTSMEN with previous experience of full-scale layout work or similar workshop practice. These vacancies are at the Cricklewood office only.

APPLICATIONS, stating age, qualifications and details of experience, to Staff Officer, Handley Page, Ltd., Cricklewood, London, N.W.2. [0640

WESTLAND AIRCRAFT, Ltd., have vacancies for the following:

STRESSMEN (INTERMEDIATE AND SENIOR).

DRAUGHTSMEN (INTERMEDIATE AND SENIOR).

TECHNICAL ILLUSTRATORS.

SPARES COMPILERS.

APPLY, stating age, qualifications, experience and salary required, to the Personnel Officer, Westland Aircraft, Ltd., Yeovil, Somerset. [0605

INTERNATIONAL AERADIO, Ltd. has the following vacancies overseas:—

(i) Radar engineer/instructor, Karachi. Inclusive salary £1,200 p.a. (Ref. RIK.)

(ii) Radio technician, preferably single, experience G.C.S.S.51 and other navigational aids. Minimum inclusive salary £700 p.a. tax free. (Ref. BN.)

APPOINTMENTS pensionable, free quarters.—Write, quoting appropriate reference, Personnel Officer, 6, Park Street, London, W.1. [0699

AQUILA AIRWAYS, Ltd., invite applications in the following aircrew categories:—

(1) Pilots, preferably with flying boat experience, but training for conversion may be given to suitable land plane applicants.

(2) Radio officers, holding 1st Class licences.

(3) Flight engineers, with "A" and/or "C" licences on Pegasus S.35.

WRITE, giving full details of experience and flying hours to 6, Curzon Place, London, W.1. [0697

A VACANCY exists in the Technical Department for an engineer to assist in work connected with the vibration problems of aircraft.

APPLICATIONS are invited from engineers with suitable experience and mathematical ability.

WRITE, stating age, experience, salary required, etc., to the Personnel Officer, Saunders-Roe, Ltd., East-Cowes, I.O.W. [0643

K.L.M. ROYAL DUTCH AIRLINES have vacancies for pilots, aged 30 or under, to enter service at the end of 1951.

PREFERENCE will be given to applicants who possess airline pilots transport licence and have experience on twin and/or four-engine aircraft, and who hold flight navigator licence or who have had long-range flying experience. Minimum of 600 flying hours.

CONSIDERATION will also be given to applications from pilots in possession of at least a commercial pilot's licence with night and instrument rating.

DETAILS in first instance to Senior Station Manager, K.L.M. Royal Dutch Airlines, London Airport, Feltham, Middlesex. [0669

SITUATIONS VACANT

GOVERNMENT OF IRAQ.

ASSISTANT forecaster required for the Basrah Port Directorate for a tour of 2 years in the first instance. Salary, Iraq Dinars 90 a month (I.D.1 £1). High cost-of-living allowance between I.D.10 and I.D.14 a month according to dependants. Provident fund. Quarters provided at moderate rental. Free passages. Liberal leave on full salary. Candidates must hold a University Degree, preferably in science and specialised in meteorology, and should be able to issue weather forecasts independently.

APPLY at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents, 4, Millbank, London, S.W.1, quoting M.28338.E on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. [0709

PROMINENT aircraft firm in Greater London are commencing new project of high importance invites applications for the following posts:—

DESIGNER for hydraulic, pneumatic, mechanical accessories such as pumps servo mechanisms, actuators, etc. A senior position with high salary and pension scheme awaits the right applicant, who should be of degree standard with several years' suitable experience, preferably in aircraft engineering.

SENIOR design draughtsman with university degree and/or Ordinary National Certificate or Higher National Certificate and experience in one or more of the following: servo mechanisms, hydraulics, pneumatics, optics and materials as related to aircraft or armament work. The position is progressive and permanent to a suitable applicant.

DRAUGHTSMEN with experience in mechanical hydraulic or pneumatic accessories. Ordinary National Certificate desirable but not essential if otherwise suitably experienced.

DRAUGHTSMEN with several years' instrument design experience.

STRESSMAN of degree standard with at least four years' experience in stressing of aircraft structures and with knowledge of materials. Permanent senior position with good salary and pension plan is offered to suitable applicant.

HONOURS graduates and graduates with knowledge of supersonic aerodynamics and/or servo mechanism approach to stability.

WRITE full details, qualifications, experience, age, salary sought, to Box AC.54414, Samson Clarke, 57-61, Mortimer Street, London, W.1. [0699

NAVIGATING officers required by Eagle Aviation, Ltd. Minimum qualification: flight navigator's licence.—Apply to Operations, Luton Airport. [0683

PILOTS and radio officers required. Appropriate licences essential.—Fairflight, Ltd., 240, High Street, Slough, Southall 2255.

DRAUGHTSMAN required by firm in Kent. Experience in aircraft design preferable but not essential. Some living accommodation available.—Box 3097. [0694

LICENSED aircraft radio maintenance engineer required immediately. Please write, Chief Engineer, Eagle Aviation, Ltd., Luton Airport, Luton, Beds. [0811

AIRCRAFT stressmen required.—Write, stating experience and qualifications, to Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [0652

TECHNICAL assistant required by a firm in Kent. Experience in aircraft stressing and some knowledge of aerodynamics preferable. Living accommodation available to suitable applicant.—Box 3006. [0693

JIG and tool draughtsmen required. Previous aircraft experience not essential. Pension and life assurance scheme. Apply, Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [0646

FOLLAND AIRCRAFT, Ltd., require a Section Leader with considerable experience of modern structural design. Apply to Personnel Manager, Folland Aircraft, Ltd., Hamble, Southampton. [0623

NORMALAIR, Ltd., Yeovil, invite applications from the following for work in connection with aircraft air conditioning, pressurizing, and high altitude breathing equipment:—

DESIGNERS.

DRAUGHTSMEN.

TECHNICAL ASSISTANTS.

TECHNICAL CLERKS.

TECHNICAL WRITERS.

TECHNICAL ILLUSTRATORS.

APPLICATIONS to the Personnel Officer, Normalair, Ltd., Yeovil, Somerset, must state age, experience, qualifications and salary required. Where convenient selected applicants will be interviewed in towns near their address. [0604

BROOKLANDS AVIATION, Ltd., have vacancies for airframe and engine fitters, electricians for servicing and repair of R.A.F. aircraft. Good wages and piecework bonus.

APPLY: No. 4 Site, Sywell, Northants. [0308

JIG and tool draughtsman required, fully experienced. Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds., stating age, experience and salary required. [0563

WANTED, flight engineers for York aircraft, "A" and "C" to cover York aircraft essential.—Apply: Chief Engineer, Eagle Aviation, Ltd., Luton Airport, Luton, Beds. [0810

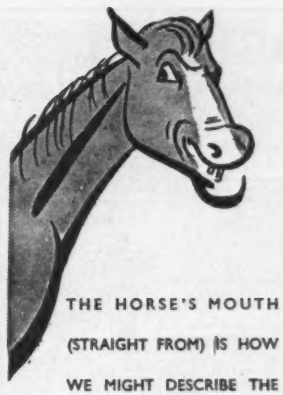
APPLICATIONS are invited from design draughtsmen and stressmen; also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.

APPLICATIONS should state full particulars of experience and qualifications and should be addressed to The Personnel Manager, The de Havilland Engine Co., Ltd., Stonegrove, Edgware, Midds. [0676

SKILLED detail and assembly fitters, turners, borers and millers urgently required. Apply, giving full details of experience, to Personnel Officer, Westland Aircraft, Ltd., Yeovil, Somerset. [0627

MALE or female technical illustrator and male technical author required for publications department.—Applications in writing, stating age, experience and salary expected, to Chief Designer, Auster Aircraft, Ltd., Rearsby, Leics. [0704

SCHEDULE clerks required (male), with experience in compiling M.O.S. spares schedules. Applications, in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., The Airport, Luton, Beds. [0596



THE HORSE'S MOUTH

(STRAIGHT FROM) IS HOW

WE MIGHT DESCRIBE THE

SORT OF EXPERT ADVICE

WE GIVE ON AIRCRAFT

CONSULT US BEFORE YOU BUY OR SELL

AIRWORK LIMITED

16 CHESTERFIELD ST., W.1. TEL. GRO. 4041

THE

DE HAVILLAND

ENGINE COMPANY LIMITED

have vacancies in their

DESIGN OFFICE at STAG LANE

for

SENIOR DESIGNERS & DRAUGHTSMEN

for work on Gas Turbine development and other projects

GOOD SALARIES & PROSPECTS

for suitable applicants

SUPERANNUATION SCHEME

Apply giving details of previous experience and salary to

THE PERSONNEL OFFICER

STAG LANE, EDGWARE

MIDDLESEX

SITUATIONS VACANT

MECHANICAL, structural or general engineering draughtsman wanted for aircraft work; previous aircraft experience not essential; pension and life assurance scheme. Apply: Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge. [0695

URGENTLY required for high-class precision work: instrument fitters, assembly fitters used to fine limits, universal millers and capstan setter operators. Apply, giving full details of experience, etc., to Personnel Officer, Normalair, Ltd., Yeovil, Somerset. [0526

EXPERIENCED airframe fitters required for work on military metal and composite aircraft. Long contracts. Union rates and bonus. Assisted travel. Canteen, etc.—Apply, Airwork, Ltd., Gatwick Airport, Surrey. [0297

TECHNICAL authors and illustrators required. Knowledge of M.O.S. procedure desirable.—Applications in writing, stating age, experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds. [0594

GLOSTER AIRCRAFT Co., Ltd., have vacancies for fully experienced aircraft structural and electrical draughtsmen.—Applications, in writing, stating age, experience and salary required, to Employment Officer, G.A.C., Ltd., Hucclecote, Glos. [0610

ENGINEER, minimum A. and C. Dakotas for private flight. His Highness, Bhopal, India. Six aircraft. Salary Rs 1,800 per month (£135) plus provident fund. Free bungalow, transport. Preference engineer pilot's "A" or above.—Further details, Box 3022. [0700

REQUIRED immediately, "A" and "C" licensed engineer, some experience approved inspection organisation desirable, also fitters, airframe and engine, required.—Apply, Air Schools, Ltd., Municipal Aerodrome, Wolverhampton. [0625

DRAUGHTSMEN, intermediate, required by light mechanical engineers (general and aircraft) for interesting new projects. Prospects and conditions excellent.—Apply, Teleflex Products, Ltd. (Aircraft Division), Chadwell Heath, Essex. [0698

TECHNICIAN (male or female), required in the Development Research Laboratory of the Aircraft Division of The Bristol Aeroplane Co., Ltd. Duties include the supervision of a small group of technicians engaged in the testing of materials, rivets, etc.

APPLICANTS should be of Degree or Higher National Certificate standard with preferably some previous experience of this kind of work.

REPLY, stating age and qualifications, to the Personnel Manager, The Bristol Aeroplane Co., Ltd. (Aircraft Division), Filton House, Bristol. [0512

STRESSMAN required for work on new and interesting projects. Experience of wing and fuselage stressing essential. Applications, stating age, qualifications and previous experience, also stating salary required to Ref. F.11.—Box 2838. [0570

SENIOR weight engineers required. Interesting work on new jets. Permanent positions offered to suitable applicants.—Apply, stating age, experience, qualifications and salary required, to Chief Designer, Gloster Aircraft Co., Ltd., Witcombe, Glos. [0912

STRESS calculator. Experienced man required by aircraft engineers in Midlands. Must hold Higher National Certificate or equivalent qualifications. Excellent prospects for keen and competent man.—State fully details of experience and qualifications, age and salary required, to Box 3023. [0701

DOWTY EQUIPMENT, Ltd., Aircraft Hydraulic Engineers, Arle Court, Cheltenham, require design draughtsmen, preferably with some knowledge of hydraulic and landing gear components for aircraft.—Write: Personnel Manager, giving details of training and experience, and mentioning age and salary range. [0692

AIR ENTERPRISES, Ltd., Renfrew Airport, Glasgow, urgently require captains and radio officers. Agreed rates of pay and conditions of employment plus flying bonus. Minimum qualifications: commercial pilots licence and instrument rating, R/T licence, radio officer's 1st class licence. [0626

AIRCRAFT fitter assemblers required by de Havilland Aircraft Co., Hatfield, offering good working conditions, modern equipment, opportunities for advancement, superannuation scheme, sports club, etc.—Apply by telephone, Hatfield 2345, in person, or by letter addressed to Personnel Manager. [0221

ONE technical assistant required for work on development of de-icing systems, must have sound aerodynamic background, with some knowledge of aircraft performance and heat transfer. Write, giving qualifications and experience, also stating salary required, Quoting Ref. M.2.—Box 2837. [0771

PLANNING engineers (aircraft) required. Considerable production planning experience and sound knowledge of metal airframe components manufacture essential.—Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0636

TOOL draughtsmen, qualified seniors and juniors, required. Varied and interesting projects. Pension scheme. Toolmakers will also be considered for some of the vacancies.—Full details to the Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middlesex, quoting Ref. PD/M2. [0641

FLYING instructors required with minimum of R.A.F. category B1 and ab initio instructional experience required for service in North of England. Salary, £750-£950 per annum.—Apply, Chief Instructor, Airwork, Ltd., No. 2 Grading School, R.A.F. Station, Digby, near Sleaford, Lincs. [0661

AIRCRAFT draughtsmen required for interesting work on turbine and piston aero engine installations. 5-day week. Good canteen facilities. Write, giving age, a detailed statement of previous experience and salary required, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0713

ROCKET motor design and development. Mechanical engineers, physicists, chemists, mechanical and civil draughtsmen, required for work in this new and rapidly expanding field, on a project connected with Guided Missile programme. Location near large industrial town in Midlands. Applications to Staff Officer, Box 3102. [0710

DRAUGHTSMEN, with experience in high quality light mechanical or hydraulic engineering, are required by progressive Midland manufacturing company. Positions with good prospects are available to younger men. Salaries will be in accordance with age, qualifications and experience.—State details, together with salary required, to Box 3010. [0779

HANDLEY PAGE (READING), Ltd., have vacancies in the Design office for senior and junior draughtsmen with aircraft experience. Also required are stressmen, who should have at least two years' experience and with a degree or Higher Ntational Certificate with endorsements in aeronautical subjects. These positions are progressive and offer excellent opportunities to the right men.—Please send full particulars to the Personnel Office, Handley Page (Reading), Ltd., The Aerodrome, Woodley, Reading. [0691

ROLLASON ENGINES LTD.

CROYDON AIRPORT
TEL.: CRO 5151/4. CABLE: ROLLAIR, CROYDON

D.H. GIPSY QUEEN III ENGINES

Now is the time for D.H. Rapide Operators to take advantage of our engine exchange scheme. A completely overhauled unit fitted in exchange for your time-expired engine in 24 Hours. PRICE INCLUSIVE **£207-10-0** per engine

SITUATIONS VACANT

AIR FORCE, Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd. Applications are invited from senior and junior draughtsmen, and stressmen, for work on this interesting programme.—Write, giving details of experience and salary required, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Luton, Beds. [0666]

H. M. HOBSON, Ltd., Fordhouses, Wolverhampton, require technical assistants for research and development work on fuel metering, and hydraulic servo systems for aircraft, and interesting new projects. Applicants should be up to degree standard in engineering. Staff hostel accommodation available for single applicants. [0662]

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft. Hobson Works, Fordhouses, Wolverhampton. [0640]

APPLICATIONS are invited from senior and intermediate design draughtsmen: experience of aero engine design desirable but not essential.—Please write, stating age and giving details of previous experience in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0649]

THE Supermarine Works of Vickers-Armstrongs, Ltd., at their Winchester Design Offices require instrumentation engineers for interesting work on high-speed aeroplanes. Qualifications preferred: engineering degree with knowledge of electronics, and practical workshop experience.—Apply, Personnel Department, Hursley Park, near Winchester. [0660]

JET engine or ram jet combustion technicians with good aero or thermodynamic knowledge required. Must have sound academic training, have had experience in the analysis of component performance from test results, and be capable of assessing performance of projected designs. Write, giving qualifications and experience, also stating salary required. Quoting Ref. M.3.—Box 3639. [0673]

THREE technical assistants of graduate standard required for development work on fuel systems for ram jets. Must have sound knowledge of hydraulics and be capable of drawing up test schedules co-operating in running of tests, and analysing the results. Knowledge of aerodynamics an advantage. Write, giving qualifications and experience, also stating salary required. Quoting Ref. M.1.—Box 3638. [0672]

ASSISTANT chief designer required for work on project of national importance in Greater London area. Knowledge of servo mechanisms, gyros and other small electrical and hydraulic mechanisms essential. Some experience of instrument design preferable. Salary up to £1,000 p.a. would be paid to suitable applicant. Pension scheme in operation.—Box AC.84030, Samson Clarks 57-61, Mortimer Street, W.1. [0606]

DEVELOPMENT engineers and senior draughtsmen required with experience in light hydraulic controls and/or fuel metering equipment; also detailing draughtsmen for this type of work. The factory is situated in the grounds of a country house and the wages and conditions are excellent. Hostel available.—Write, Personnel Manager, Dowty Equipment, Ltd., Arle Court, Cheltenham. [0603]

QANTAS EMPIRE AIRWAYS has vacancies in New Guinea and Australia for single men experienced on engines, airframes, electrics and instruments of Dragon, DC-3, DC-4 and Short flying boats. Preference will be given to licensed engineers.—Applications should be submitted to the Engineer Liaison Officer, Qantas Empire Airways, Airways Terminal, Buckingham Palace Road, London, S.W.1. [0705]

THE GLOSTER AIRCRAFT Co. requires senior and intermediate stressmen to work on designs and projects of advanced interest. Excellent prospects of advancement for sound and energetic men.—Apply, in first instance, giving full particulars of technical qualifications, age, experience and salary required, to The Chief Designer, Gloster Aircraft Co., Ltd., Hucclecote, Glos. [0911]

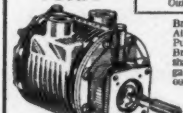
SENSITIVE ALTIMETERS

By Kollsman. Made for the U.S.A.A.F. Reads to 50,000ft; 3-pointer type, dial calibrated in 20ft. markings. With adjusting knob, and scale marked in inches of mercury for day-to-day correction. Standard aircraft instrument size, with 3in. dial. Flange fixing to panel. Post free. **85/-**

HAND-BEARING COMPASS

The finest ever made. Designed for R.A.F. Includes prism, jewelled-bearing magnetic system (parallel magnets). Card marked 0-360 deg. by degree divisions. Torch in handle, night use. Air clearly marked. Supplied in fitted transit case. Recommended for high-precision survey work, yachtsmen, navigators, etc. Maker's price well over £30. Carriage paid Our price. **65/-**

VACUUM PUMPS



Brand new high quality Air Ministry Vacuum Pumps by well-known British firm. 2in. splined shaft, ¼in. diam. standard gas thread inlet and outlet. Weight 5 lbs. Needs at least ½ h.p. to drive it. Flange mounting. Has many industrial workshop and lab. uses. Size approx. 6 x 4 x 4 ins. Post Free. **45/-**

16M.M. CINE FILM

Negative safety Wound emulsion outwards. British. Per tin 300ft. (12 rolls, 25ft.). Post free. **17/6**

PILOT'S COMPASS

Beautifully made R.A.F. P-type compasses, spirit filled, clear card, expansion chamber and long luminous pointer with steering-grid. The compass has a revolving grid for course-setting on to a bearing and is supplied in wooden transit case. Diameter of bowl 4in., overall diameter 6in. Easily fitted by means of three attached lugs and ideal for small craft, launches, etc., etc. Almost new. Listed by makers at over £25. Post free. **26/6**

AERO-SPARES CO.
(Dept. 8), 70-71 HIGH HOLBORN, LONDON, W.C.1
Phone: AMB 2871.

EAGLE AVIATION
Limited
offer a complete aeronautical service
4 AVRO YORK AIRCRAFT—World-wide Charter
45 passengers—8 tons freight
AIRCRAFT OVERHAUL AND MAINTENANCE
SALES AND PURCHASE OF AIRCRAFT
HEAD OFFICE: 29 CLARGES ST., LONDON, W.1
Telephone: GROvenor 6411 (10 lines)

SITUATIONS VACANT

SAUNDERS-ROE, Ltd., invite applications from all grades of draughtsmen for employment in their aircraft drawing office at Cowes, and from junior draughtsmen for employment in their helicopter division at Eastleigh (Southampton).—Write, stating age, qualifications, experience and salary required, to the Personnel Officer, East Cowes, I.o.W. [0500]

A VACANCY exists in the electronics section of the research department for an electronics engineer, preferably with a degree in mathematics, for the design of equipment for electronic measurement of physical variables and associated problems.—Applications stating age, qualifications, experience and salary required, should be addressed to the Personnel Officer, Westland Aircraft, Ltd., Yeovil, Somerset. [0691]

NORMALAIR, Ltd. invite applications from designers and draughtsmen for work in their London office, in connection with aircraft air-conditioning, pressurising and high altitude breathing equipment. Experience of aircraft equipment or delicate precision mechanisms is essential, only first-class qualified men will be considered.—Applications stating age, experience, qualifications, and salary required should, in the first instance, be addressed to the Personnel Officer, Normalair, Ltd., Yeovil, Somerset. [0690]

CHIEF development engineer required to form a new department for work on small electrical and hydraulic mechanisms. Knowledge of servo and gyro practice is desirable. Applicants must be of British birth with several years' experience of development engineering associated with the aircraft industry. Applicants must be in receipt of a salary of not less than £900 p.a. The post is for employment in the North London area, and is pensionable.—Write full details, qualifications, experience, age, to Box A.C.84035, Samson Clarks, 57-61, Mortimer Street, W.1. [0697]

THE GLOSTER AIRCRAFT Co. requires the services of a number of aerodynamicists, (a) for design and project work, and (b) for flight test reduction. Opportunity exists for individuals to vary their experience within the Aerodynamics Department. Candidates with some years' experience preferred but applications from juniors with sound mathematical ability will receive full consideration.—Apply, in the first instance, giving full particulars of age, experience and salary required, to The Chief Designer, Gloster Aircraft Co., Ltd., Hucclecote, Glos. [0913]

FLIGHT REFUELLING, Ltd. require a junior stressman and technician for interesting work on experimental aircraft installations. Minimum qualification H.N.C. (Mech.). Previous experience of aircraft component stress analysis desirable but not essential. Commencing salary in the range £400-£500 p.a., according to qualifications and experience. 5-day 40-hour week. Pleasant working conditions. Canteen and sports club.—Apply, stating age, qualifications, experience and salary required to Personnel Manager, Tarrant Rushton Airfield, near Blandford, Dorset. [0974]

BRITISH OVERSEAS AIRWAYS CORPORATION offer opportunities of work on modern air liners to the following tradesmen: electricians, engine and airframe fitters, sheet metal workers and instrument and radio mechanics experienced in the maintenance or overhaul of aircraft and/or components. Rates of pay 2s. 10d. per hour plus 4½d. per hour provisional bonus. Attractive proficiency pay up to 3d. per hour. 5-day, 44-hour week. Possible shift work. Good pension, sick pay and holiday facilities.—Write or call, Staff Manager, Hut 29, London Airport, Feltham, Middlesex. [0800]

WANTED

STEEL, aluminium, brass. Sheets, strip, bars, off-cuts. Any quantity, immediate payment.
GRADES SHEARED METAL Co., Ltd., Green Lane, Hounslow, Middx. Tel.: Feltham 3274. [0686]

STEEL hangars, pref. Pentad, req'd immed. Incomplete structures considered.—Box 3097. [0707]

BOOKS, ETC.

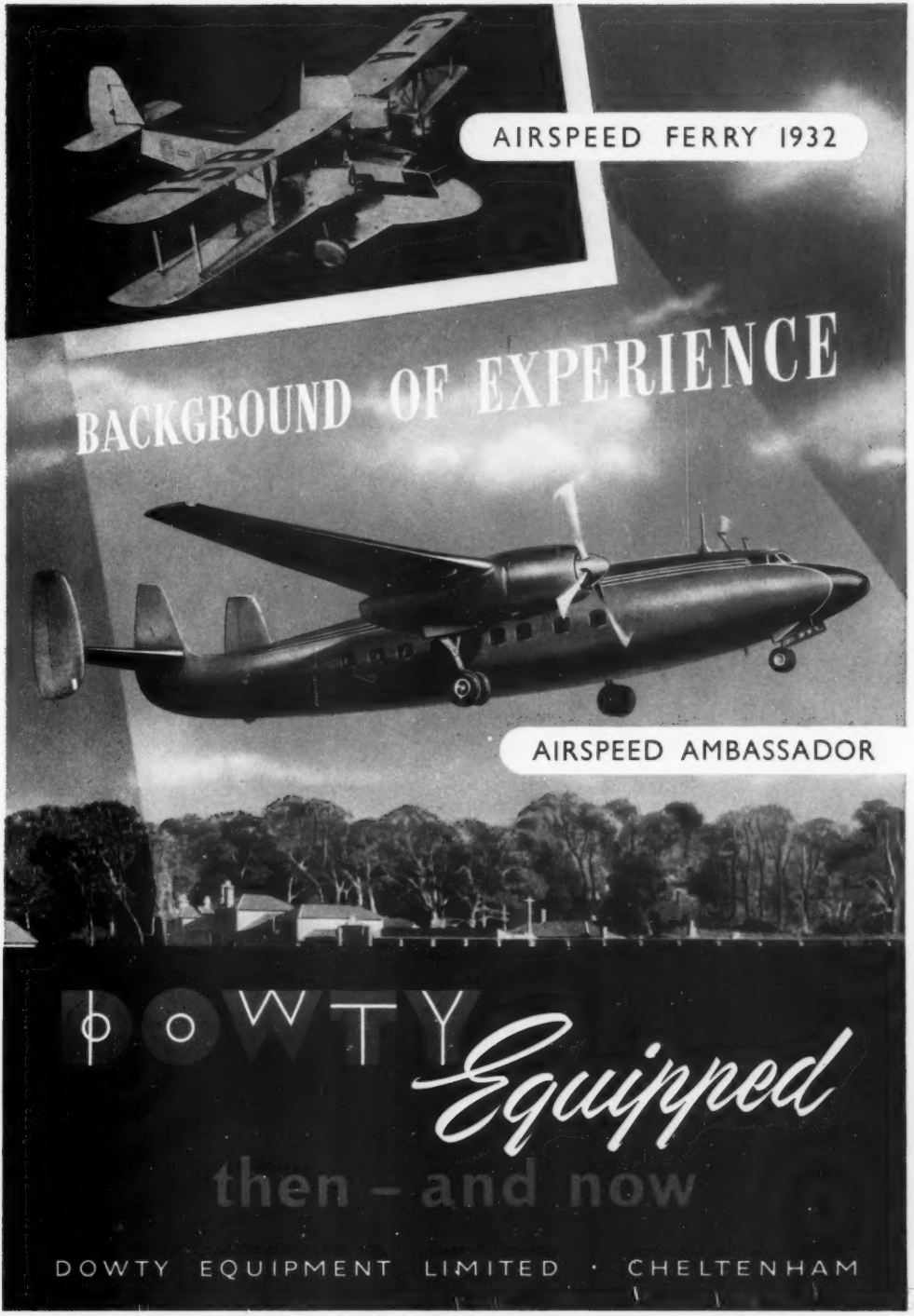
FOR sale. "Flight," January, 1946 to December, 1948. Offers.—17, Queens Road, Walton-on-Thames, Surrey. [0702]

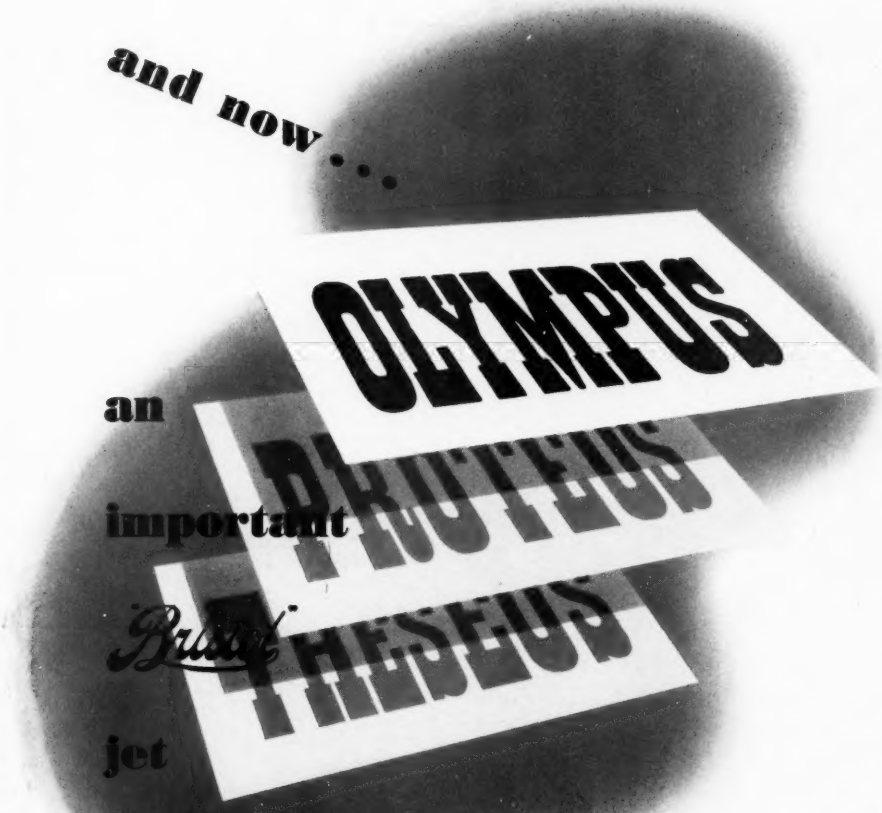
Jubilee
PATENTED WORM DRIVE CLIP

Absolutely leakproof joints on Air, Water, and Oil lines, are swiftly and easily made by using "Jubilee" Worm Drive Clips. They stand up to any pressure.
★ *Write for details quoting reference*
THE FINEST CLIP IN THE WORLD.
L. ROBINSON & CO. (GILLINGHAM) LTD.
Gillingham Kent

★ *Wanted for Cash*
STEEL BUILDINGS AND HANGARS
Send details to
UNDERWOOD CONSTRUCTION LTD.
Argall Works, Argall Ave., Leyton, E.10. *Tel: LEY 6968*

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London, and Watford, Herts. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.


AIRSPEED FERRY 1932
BACKGROUND OF EXPERIENCE
AIRSPEED AMBASSADOR
DOWTY
Equipped
then – and now
DOWTY EQUIPMENT LIMITED · CHELTENHAM



latest addition to a range of "Bristol" gas-turbine aero-engines, of which the Theseus and Proteus propeller-turbines have shown successive increases in power and efficiency, the powerful Olympus jet engine promises to enhance "Bristol" leadership in the aero-engine field.

THE BRISTOL AEROPLANE COMPANY LIMITED · ENGLAND

9558